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COLONY AND PROTECTORATE OF KENYA

Department of Agriculture
(DIVISION OF VETERINARY RESEARCH)

AIDS TO
STOCKOWNERS

By

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AIDS TO STOCKOWNERS

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Preface to Third Edition.

The first edition of the pamphlet, " Aids to Stockowners," was published in October, 1920, and a revised edition in September, 1923.

The constant progress in veterinary research necessitates frequent revision of stock-disease pamphlets, and the third edition has been compiled for the purpose of furnishing stock-owners with more up-to-date knowledge of the commoner stock diseases met with in this Colony. It also deals with several diseases and conditions responsible for losses in stock which were not described in the previous editions, e.g. poisoning by some of the commoner chemicals, plant poisoning, snake-bite, Laikipia lung disease of sheep, sheep-pox, fowl-pox, paratyphoid of calves, etc.

Part I includes a summary of our present knowledge of the commoner stock diseases which occur in the Colony.

Part II.—Laboratory methods.

Part III.—Miscellaneous.

An Appendix is added giving the native names of acute diseases affecting cattle.

Generally speaking, the most important stock diseases of the Colony may be grouped as follows :—

1. Those spread by direct contact with affected animals or their morbid products, e.g. rinderpest, pleuro-pneumonia, anthrax, swine fever, contagious abortion, stomach and intestinal parasites.

2. Those in which infection is conveyed by an animal parasite such as a tick or insect, e.g. heartwater, blue tongue, horse-sickness, redwater, gallsickness, East Coast fever, etc.

3. Those in which an animal parasite, such as a tick, probably plays an indirect role in the spread of infection, e.g. streptothricosis, ulcerative lymphangitis, bovine lymphangitis, etc.

With the few exceptions mentioned in the pamphlet, no drugs or medicines are at present known which may be considered specific in the curative treatment of the diseases dealt with therein. Some may be successfully combated with sera

or vaccines, but no method of preventive inoculation has so far been introduced for dealing with others. Some of the latter, e.g. heartwater, etc., may be suppressed by other measures; one of the most effective weapons being dipping, which aims at the destruction of the actual transmitting agent.

A factor of importance and one of the obstacles in the eradication of some of the diseases of animals is game and vermin. Some are responsible not only for their spread, e.g. rinderpest and swine fever, but, as hosts, play a role in the maintenance of others—stomach and intestinal worm infections, trypanosomiasis (fly disease), etc.

In the case of the domesticated animals, the recovered animal may also be the reservoir of the virus, e.g.—

> Redwater and gallsickness (anaplasmosis) in cattle;
> Biliary fever in the horse;
> Biliary fever in the dog;
> Trypanosomiasis (fly disease).

In order that the spread of infection may be reduced to a minimum, effective measures of control should be put into operation without delay; a correct and early diagnosis is therefore of primary importance.

It is recommended in cases where the services of a veterinary officer are not available that owners should forward without delay material as indicated in this pamphlet to the laboratory for examination should any doubt or difficulty arise.

Revision of " Aids to Stockowners " has been carried out with regard to practical utility and in the hope that it will continue to be of assistance to stockowners.

The assistance of the research officers of the Veterinary Research Laboratory was obtained when compiling this edition, and references have been made to the publications of various authorities and also to the Reports of the Director of Veterinary Education and Research, Onderstepoort, and it is hoped that this general acknowledgment will be accepted by all as an acknowledgment of indebtedness to them.

J. WALKER,
Chief Veterinary Research Officer.

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AIDS TO STOCKOWNERS

PART I.
A Description of the Commoner Stock Diseases which occur in Kenya Colony.

A.—DISEASES OF CATTLE.
RINDERPEST.

This is probably the most serious disease met with in cattle. In view of its highly contagious nature it is liable to spread rapidly through susceptible cattle and through susceptible game to all parts of the country. Owing to the frequency of its transmission by game, great care should be taken to avoid the infection from this source. There are a number of different kinds of game said to transmit rinderpest, viz. buffalo, eland, bushbuck, waterbuck, wart-hog, impala, bush-pig, reedbuck, and probably some others.

CAUSE.

The causal agent of rinderpest is an untravisible virus which affects the blood-stream, the body tissues and secretions (saliva, etc.) of an affected animal.

MODE OF INFECTION.

The virus usually gains entrance to the body through the mouth during the ingestion of contaminated food or water. Contamination of foodstuffs results from the passage of the natural secretions of a sick animal. The virus can be transferred indirectly from infected to clean areas by such intermediaries as humans, dogs, vultures and carnivorous vermin carrying meat from carcasses dead of the disease.

INCUBATION PERIOD.

By incubation period is meant the time that elapses between the moment the infective virus or organism gains entrance to an animal's body and the time at which the first signs of the disease become evident. In rinderpest, as in many other diseases, the first sign is a rise of temperature. The incubation period of rinderpest, when contracted naturally, varies from three to nine days.

Marked clinical symptoms, however, are not manifested for several days after the rise of temperature takes place, and it should be remembered that during this period the affected beast is capable of infecting others which may live in contact with it.

SYMPTOMS.

As already stated, the first disturbance is an elevation of temperature up to 103° or thereabouts on the first day and to 105° or 106° F., or thereabouts, on the second or third day. The temperature remains elevated until a day or two before death, when it suddenly drops to sub-normal. The first symptoms which strike the eye are dullness, loss of appetite, staring coat, followed later by a muco-purulent discharge from the eyes and nose, and marked salivation. Diarrhœa usually sets in, weakness ensues, and continues until the animal is unable to rise. If the lips and tongue of the animal are examined towards the later stages of the disease they will be found highly inflamed and their surface very much excoriated and covered with cheesy-like deposit. This symptom is very typical of rinderpest, and its presence, in conjunction with the above, is positive evidence of the disease. Death usually occurs within a week or ten days after the first visible symptoms are noted in cases ending fatally.

POST-MORTEM LESIONS.

In this as in all other diseases post-mortem examination should be carried out immediately or within a few hours of death. The longer the carcass remains unexamined the more will putrefactive changes occur to obliterate the true state of disturbance brought about by the disease.

Mouth and Tongue.—As described above under " Symptoms," we frequently find here one of the most typical signs of rinderpest. As a rule, inside the lips, under the tip and sometimes along the sides of the tongue, and on the gums will be noted a peculiar inflammation roughly resembling a fly-bitten surface covered over with a deposit resembling cream cheese.

Stomach.—The fourth stomach will be found highly inflamed, and its contents often blood-tinged. Numerous ulcers or sores will be frequently found on the inside lining membrane; these sores vary in size from a millet seed to that of a florin piece.

RINDERPEST ULCERATED GUMS

INTRALOBULAR SEPTA.

SOLIDIFIED PATCHES.

PNEUMONIA.
LUNG - BOVINE.
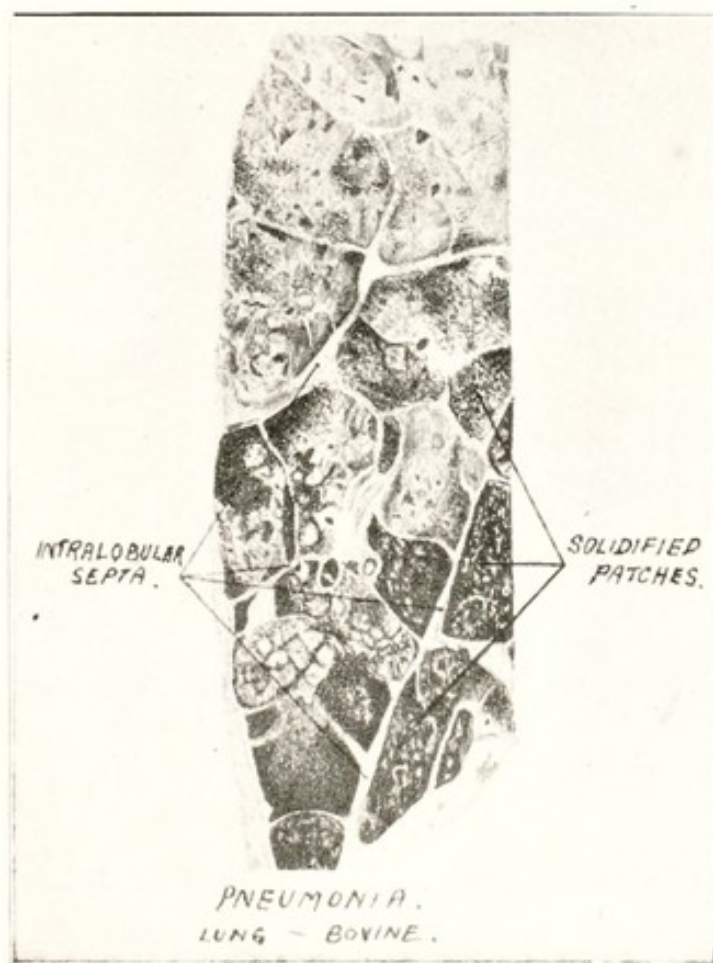
RINDERPEST PNEUMONIA LUNG.

Intestines.—Throughout the whole of the intestines inflammation usually exists, ulcers occur, and the contents are frequently blood-coloured. A greyish deposit may also be seen on portions of the mucous membrane of the bowels.

Lung.—In a number of cases these will show emphysema (*see* Part II).

Heart.—The inner and outer linings of the heart usually show many hæmorrhages.

Spleen.—This organ is sometimes enlarged to double its normal size.

Liver.—The liver is often swollen and is usually very rich in blood. Friability is also noticeable in a number of cases.

Kidneys.—As a rule these are engorged with blood.

Urinary Bladder and Urine.—In uncomplicated cases no marked changes are seen, but redwater being a frequent complication of rinderpest the urine may be of a dark red or coffee colour.

Treatment.

An animal which has been suffering for some days from rinderpest contracted naturally does not, as a rule, recover, but if the symptoms are detected early enough, that is, during the first or second day of the temperature reaction, a cure might be effected by inoculating the animal with a large dose of anti-serum. A few hundred (250 to 500) cubic centimetres can be inoculated without ill effects.

Bleeding a few hundred cubic centimetres of blood from the jugular vein when the symptoms are alarming, viz. pulse frequent, respirations markedly accelerated, and temperature considerably elevated, appears to be beneficial, and could be resorted to in the case of valuable animals.

Preventive inoculation is the usual method employed to combat the disease. There are two methods of carrying out this inoculation; one, which is commonly called "single inoculation," comprises the injection of a dose of serum alone which controls the reaction should the animal contract the disease naturally. The injections should be repeated at fortnightly intervals until all risk of infection has disappeared.

In Kenya Colony, the simultaneous method known as "double inoculation" is usually employed, but in instances— e.g. (1) to reduce the risk of losses likely to arise from contact

infection pending simultaneous inoculation of the herd, and (2) where the latter is not desirable, as in the case of cows and heifers heavy in calf and valuable imported stock—the " single inoculation " method is indicated.

Double inoculation comprises the injection of the virus itself in the form of blood collected from a reacting animal during the height of the temperature reaction and which should be inoculated without delay, and, immediately after, a dose of serum which is calculated to counteract the fatal effects of the virulent blood to the extent of allowing the animal to sicken and subsequently recover. With the exception of young un-weaned calves, an animal which so reacts and recovers is considered permanently immune to rinderpest, and is branded on the left rump with the letters " A.M." It has been found that some sucking calves up to five months or so of age possess a marked degree of natural immunity to the disease. This immunity, even though it may be strengthened by artificial means, eventually passes off, leaving the animal susceptible.

Owing to the intricacy of the double-inoculation method, it is inadvisable for a layman to undertake the operation.

DIRECTIONS FOR THE USE OF ANTI-RINDERPEST SERUM.

The serum is issued in units of 50 c.c. in quantities of from 250 c.c. and upwards. The price is Sh. 2 per unit of 50 c.c.

Properties.—Anti-rinderpest serum varies in colour. It may be reddish-yellow or brownish-yellow. It should have a characteristic but inoffensive odour.

A small quantity of carbolic acid is added as a preservative, which does not, however, prevent the growth of the accidental bacteria which may gain access during its preparation; these should not produce ill effects of any importance in the inoculated animal. If not intended for immediate use, the serum should be kept in a cool dark place, and when stored under these conditions should be effective for about two years.

Every care is taken in the preparation of the serum, but no guarantee is given regarding its safety or efficacy.

Outbreaks of rinderpest and their control are dealt with by the veterinary field staff under the direction of the Chief Veterinary Officer or his deputy.

METHODS OF INOCULATION.

(1) *Serum Alone Method.*

When the possibility exists of a susceptible herd becoming infected with rinderpest, owing to the occurrence of the disease in the vicinity or to other causes, or when the disease has actually appeared in a herd, the inoculation of serum alone is *sometimes* resorted to.

Some at least of the susceptible animals under serum treatment may contract rinderpest by contact if the disease has already appeared amongst them; others escape infection.

Mode of Employment.—The serum is inoculated subcutaneously behind the shoulder at intervals of a fortnight until all trace of the disease has disappeared in the herd or, in the event of the disease being in the vicinity, until all danger of infection occurring therefrom has disappeared.

Dose.—For cattle of average susceptibility, the dose is 15 c.c. per 220 lb., equalling 100 kilos. (approx.) live body weight, but for highly susceptible animals this dose should be increased to 20 c.c. per 220 lb. live body weight, or more, on the recommendation of the veterinary officer.

Result of Inoculation.—Animals which contract rinderpest by contact when under serum treatment usually recover and acquire immunity. Increased doses, for adults 200 to 300 c.c., or, in the case of highly susceptible adult animals, 500 c.c., may be effective as a curative if injected in the early phase of the disease. The serum has no curative effect in the later stages of rinderpest.

(2) *Serum and Virulent Blood Method (Double Inoculation).*

This method necessitates the subcutaneous injection either in the neck or behind the shoulder of—

(*a*) a suitable dose of serum; and

(*b*) 2 c.c. of fresh virulent blood subcutaneously on the other side of the body.

Result of Inoculation.

(1) After an average incubative period of about five to six days, symptoms of rinderpest are usually apparent. (It is most important that the virulent blood should be collected during the temperature reaction to rinderpest, and used without delay, to avoid non-reactions occurring in inoculated cattle.)

(2) In exceptional cases, although the febrile reaction may not be a typical one, visible symptoms of rinderpest may appear.

(3) As a rule, the animal has recovered from the effects of the rinderpest reaction by the fourteenth day after inoculation and is then immune.

In the case of animals exposed in the open the temperature should be taken in the morning before 8 a.m., as the temperature of exposed healthy animals may rise as high as 105° F. later in the day.

Dose.—For cattle of average susceptibility, the dose of serum is 20 c.c. per 220 lb. live body weight, but this should be increased for highly susceptible cattle on the recommendation of the veterinary officer.

Warning.—The reaction to rinderpest contracted either naturally or by inoculation may produce—

(*a*) a recurrence of redwater and anaplasmosis or other protozoal diseases in animals already recovered from these infections. Redwater is the commoner and perhaps of most importance, and shoul be treated in its early phase by an injection of trypanblue. The breakdown in immunity to these infections may produce a marked anæmia;

(*b*) abortion in female stock.

The dipping of calves at regular intervals from or shortly after birth may result in their being susceptible to tick-borne diseases. The possibility of redwater and anaplasmosis being transmitted by the virulent blood should receive particular consideration prior to double inoculation of regularly dipped stock being carried out.

Unweaned calves possess in many instances a partial but not complete immunity to rinderpest. In some cases, no apparent reaction occurs in unweaned calves as the result of inoculation.

Generally speaking, the partial immunity appears most marked amongst unweaned calves up till two or three months after birth and decreases gradually from then onwards till after weaning, and has usually disappeared a few weeks later.

Re-inoculation of calves should be carried out according to the recommendations of the veterinary officer.

Immunisation of Imported Stock

Pure-bred or other cattle imported from countries where rinderpest does not exist, e.g. Great Britain, South Africa, etc., are highly susceptible, and it is sometimes difficult even when a high index dose of anti-serum is used to control the reaction to rinderpest, and double inoculation is not generally recommended. Imported British cattle and some South African cattle are susceptible to the redwater and anaplasmosis of Kenya Colony, and should it be necessary to immunise them by the simultaneous method precautions should be taken to use rinderpest blood free of these infections, or if not available, fresh nasal virus collected from a rinderpest reacting beast during the second day of the temperature reaction could be substituted. The immunisation (simultaneous method) of imported cattle which have recently recovered from redwater and gallsickness immunisation is not recommended owing to the risk of recurrences of these infections consequent on the rinderpest reactions.

Double inoculation should not be carried out—

(*a*) when cattle are in poor condition;

(*b*) when the grazing is poor;

(*c*) in wet weather;

(*d*) when animals are recovering from diseases such as redwater, gallsickness, etc.

The dipping of cattle when reacting to rinderpest is not recommended.

Antiseptic precautions should be taken in carrying out the inoculations.

All vessels used for containing serum should be boiled for fifteen minutes prior to use.

Syringes and needles should be sterilized in boiling water prior to and frequently during operations.

The hands of operators should be washed prior to commencement and also after completion of the double inoculation.

The site of injection should be washed with an antiseptic such as 5 per cent solution of Jeyes' or 2 per cent lysol.

Abscess formation sometimes appears at the site of the serum injection. This seems to occur particularly in cases where absorption of the serum is not aided by rubbing and where the hair at the site of injection has not been previously

clipped and the skin well washed with an antiseptic; various organisms are usually present on the skin and are likely to be subcutaneously inoculated by the needle and cultivate in the serum, which is a suitable medium for the growth of organisms.

Note.—The correct estimation of the live body weight is of considerable importance as the aforementioned doses of serum for cattle of average susceptibility are based on this.

RINDERPEST VACCINE.

In some countries, notably in the Philippines, vaccination has been substituted for the simultaneous method of immunisation. It consists of the inoculation of treated spleen collected from a beast reacting to rinderpest.

At the present state of our knowledge, the vaccine confers immunity for varying periods.

Since vaccination may be of assistance in the control of rinderpest in this Colony, the method is being investigated, and experimental inoculations are being carried out under field conditions.

EAST COAST FEVER.

CAUSE.

The cause of East Coast fever is a minute microscopic protozoal parasite resembling the group of piroplasms, technically known as *Theileria parva*, which can be detected by a microscope in stained organ smears (lymphatic glands, spleen, kidneys, etc.), and sometimes in the blood of an affected animal.

MODE OF INFECTION.

The piroplasm is transmitted from a sick to a healthy beast by the agency of ticks.

Transmission is not direct; in other words, the tick which sucks the infection in its larval or nymphal stage from the sick animal must moult into another stage, the larva into a nymph, the nymph into an adult, before it can transmit the disease. So far there is no evidence that infection passes through the egg. If the infected tick is unable to find a host immediately, it can under favourable conditions remain alive up till about twelve months, and still be capable of transmitting the disease at any time within this period. An observation of importance in connexion with transmission has been recorded, viz. an infected adult tick transmits East Coast

RINDERPEST—TEMPERATURE REACTION.

Disease :
RINDERPEST

Number : ×3197

Description :
BOVINE

Remarks :
VIRUS MAKER

To face page 10.
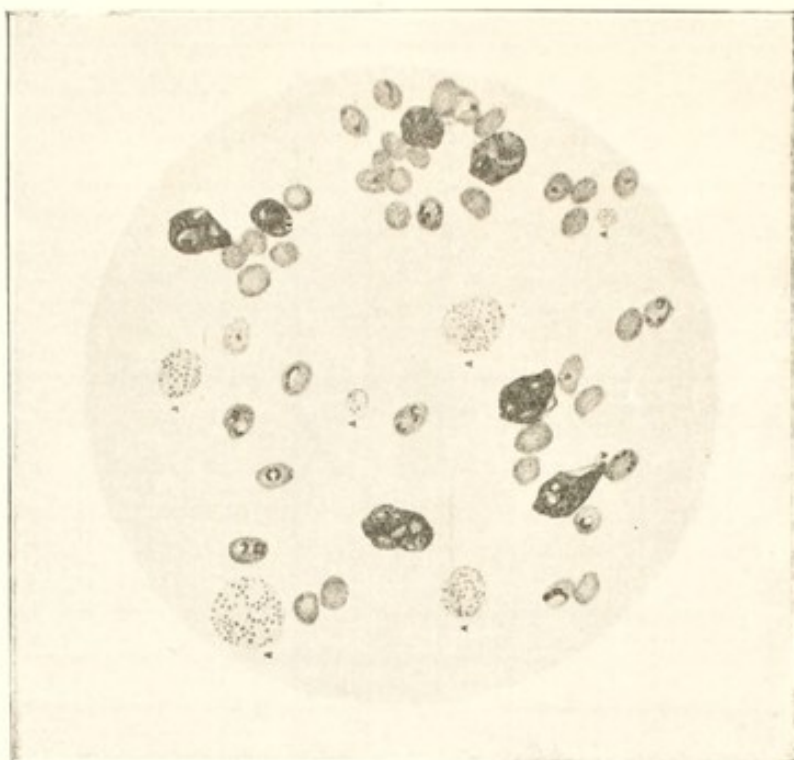
SPLEEN SMEAR OF EAST COAST FEVER,
SHOWING (A) KOCH'S BODIES

ENLARGED LYMPHATIC GLANDS (X) OF EAST
COAST FEVER BEAST.

fever only after it has been biting for a period of not less than sixty hours, and is then only infective for a period of sixty hours, so that after the lapse of 120 hours it can no longer transmit the disease. An infected tick which is removed or accidentally detached from a beast during the period of five days after its first attachment and then gets on to a susceptible animal will transmit the disease if it is able to bite and attach.

Incubation Period and Duration of the Disease.

The average period is about thirteen days. The shortest known period is six days, the longest twenty to twenty-five days. The disease runs its course in about six to twenty days; average, about eight days. In cases which end fatally, death usually occurs in about twenty to twenty-five days after the animal was bitten by infected ticks.

Symptoms.

The temperature usually rises on the first day of the temperature reaction to 104° F., or higher. The animal becomes listless and lags behind the others. It is commonly noted that the beast although visibly sick continues to feed until the disease is well advanced; one of the most characteristic symptoms is the enlargement of the lymphatic glands, those below the ears, in front of the shoulder and in the flank being particularly noticeable. As the disease advances, the symptoms become more marked. Oedema of the lungs frequently sets in, in which case there occurs a marked disturbance of the respirations. In the later stages the animal goes down and is unable to rise, or rises with difficulty.

East Coast fever is often complicated with a recurrence of redwater, and it is usual to find in such instances a yellow discoloration of the visible mucous membranes.

In some cases the eyes are affected. A whitish film appears on the surface of the eyeball and blindness results; in cases which recover the animal regains its sight. The mortality in cattle, other than calves, reaches as high as 95 per cent.

Post-mortem Appearances.

Lungs.—These are often distended with a frothy exudate (oedema). The froth sometimes escapes through the nostrils immediately before or after death. When the lungs are thus affected there is usually a good deal of yellow liquid in the chest cavity.

Fourth Stomach.—Inflammation, with a number of ulcers, is commonly present.

Intestines.—The intestines are usually acutely inflamed, and the contents may contain some blood. Hæmorrhages in the form of bright red spots of the size of a pea are common in the fourth stomach and intestines.

The liver is usually enlarged with its edges rounded; when the disease is complicated with a recurrence of redwater the liver may be yellowish in appearance.

The gall-bladder is usually full of bile, and the bile thick in consistency.

Spleen.—This is as a rule swollen, sometimes to double or treble its normal size.

Kidneys.—The most characteristic lesion is met with in these organs, viz. red or pale yellowish-white spots, varying in size from a pin-head to a pea, on the surface of the kidney, known as " infarcts." They are not present in all, but in a high percentage of cases. The yellowish-white infarcts usually show a dark inflammatory ring round their base.

Urine.—The urine may be claret-coloured as the result of a concomitant attack of redwater. In uncomplicated cases the colour of the urine appears normal, viz. amber colour and clear.

Lymphatic Glands.—As mentioned above under " Symptoms," these organs will be found much enlarged. On incision they are found to be hæmorrhagic and œdematous; a good deal of fluid escapes from the cut surface.

Flesh.—In cases complicated with redwater or anaplasmosis, the flesh has a yellowish appearance.

TREATMENT.

Medicinal treatment has proved to be of little or no assistance. Curative treatment with various chemicals and dye preparations has so far proved ineffective, but further work remains to be carried out in this direction.

PREVENTIVE MEASURES.

At the present state of our knowledge, fencing and dipping combined with hand dressing offer the best means of combating the disease.

EAST COAST FEVER KIDNEY SHOWING
WHITE INFARCTS.

Dipping.—Dipping in an arsenical dipping fluid, combined with thorough hand dressing of the parts to which the dipping fluid does not get access, viz. inside the ears, hairy margins of the ears, eyelids, under the tail, brush of tail, prepuce in males, etc., is successfully employed for the destruction of ticks; the stock collect the ticks and carry them to the dip, hence the greater the number of dipped stock to the acre the sooner will tick-eradication be effected. It should be borne in mind, however, that game, including small game and vermin, are hosts, and maintain tick life. Dipping, to be effective, should be carefully carried out, and the stockowner is recommended to peruse the pamphlet on dipping published by the Chief Veterinary Officer, Nairobi.

Dipping and hand-dressing is the most reliable method to deal with East Coast fever. Theoretically, dipping every three days in a three-days' strength dip, combined with hand-dressing, should control East Coast fever; but in practice, dipping in a seven days' strength dip at five days' interval, *combined with hand-dressing*, is now frequently used and with success.

In South Africa, five-days' dipping in a seven days' strength, combined with hand-dressing, is usually employed, and in addition the cattle are hand-dressed in between the dippings; thus if a beast is dipped and hand-dressed on a certain date it is hand-dressed forty-eight hours later, and ninety-six hours after the original dipping combined with hand-dressing it is again dipped and hand-dressed.

The good results of short-interval dipping are due to the fact that an infected tick does not immediately, as stated above, discharge infection the moment it attaches. Hand-dressing in between the five-days' dipping should further reduce the risk of infected ticks discharging infection.

It is the custom to hand-dress the cattle after they pass through the dip. Various preparations are used for hand-dressing. In South Africa, Delmore's proprietary tobacco extract is mixed with oil in the proportion of one of tobacco extract to six of oil; this is used with success. Some owners purchase old motor oil for mixing with the tobacco extract, but precautions should be taken not to use motor oil containing impurities, e.g. acid, paraffin.

At the present state of our knowledge, cases of East Coast fever may occur up till fifteen months after the last case, but in practice it is difficult to determine when the last case

actually occurred, and under the conditions existing in this Colony it is possible for an illicit movement of infected stock to occur through an estate, in which case the difficulty of determining when infection last occurred is increased ; in any case, once dipping and hand-dressing is commenced, it should be continued with a view to the eradication of infected as well as non-infected ticks.

A temporary measure of saving the cattle when the disease has appeared in a herd and a dipping tank is not available, is to move the herd from the infected to a non-infected area through clean camps ; the cattle are moved to a portion of the clean grazing sufficiently large to provide grazing for thirty days. This should be divided into two portions. The cattle are first moved to one portion, where already-infected cattle will show symptoms and the ticks attached at time of the entry into the camp will drop, and since ticks which drop cannot transmit infection until after moulting into the next stage, the cattle can be kept there for eighteen days without risk of infection. They should then be moved to the other portion of the camp, where the remaining infected cattle should show visible symptoms, and in which the infected ticks will drop, and kept there for eighteen days, when they could be moved to the clean area. By taking the morning temperature daily the disease can be recognised with some certainty amongst the cattle when in the camps. Any showing a high temperature should be considered as suspicious and removed back to the infected area.

TICKS.

A knowledge of the ticks which carry East Coast fever and their life history is essential for the control of the disease by dipping. Various species of ticks belonging to the genus *Rhipicephalus* are known transmitters, e.g. the common brown tick (*Rhip. appendiculatus*), the Cape brown tick (*Rhip. capensis*), *Rhip. nitens*, the black pitted tick (*Rhip. Simus*), and the red-legged tick (*Rhip. evertsi*). Of these, the brown tick (*Rhip. appendiculatus*) appears to be the common carrier in Kenya Colony.

The Brown Tick.—The common brown tick (*Rhip. appendiculatus*) and the Cape brown tick (*Rhip. capensis*) are included under this name. They have a similar life history ; that is to say, the larvæ, after attaching to a host, engorge and drop in from about three to seven days. The larva moults on the ground into a nymph. This occupies from sixteen to twenty-one days ; average, twenty-one days. The nymph,

when ready for feeding, seeks a host, and after attaching engorges and drops in from three to seven days, and moults on the ground into an adult in about eighteen days' time. The adult male and female after attaching mate, and the adult female drops engorged in from about four to seven days, and commences to lay eggs in about six days' time. These hatch in about twenty-eight days in the warm season.

The black pitted tick (*Rhip. Simus*), which is also a three-host tick, hatches from the eggs in about thirty days' time. The larvæ do not attach readily to cattle or horses, but to other animals, in particular the dog, and the intermediate stages are found on smaller animals. The larvæ, after engorging, drop and moult into nymphs in about twenty days' time; the nymphs into adults in about twenty-five days.

The red-legged tick (*Rhip. evertsi*) is a two-host tick. The young larvæ are usually to be found inside the ears. They do not drop after engorging, but moult on the host into nymphs. The nymphs engorge and are ready to drop in from ten to fifteen days after attaching as larvæ. The moulting (nymphs to adults) takes place on the ground, and occupies about twenty-four days. The adults usually attach to the hairless parts of the body, particularly under the tail.

The brown tick (*Rhip. appendiculatus*) transmits the disease in its nymphal stage after the larva has fed on a sick beast, and in its adult stage after the nymph has fed on an affected animal. The red-legged tick (*Rhip. evertsi*) transmits in its adult stage after the larva and nymph has fed on a sick beast.

IMMUNISATION.

This consists of intravenous, subcutaneous and intradermal inoculation of spleen pulp mixed with blood of an affected beast which produces a reaction to East Coast fever from about the fourteenth day after inoculation in a varying percentage (30 to 40 per cent) of susceptible cattle, other than calves. To complete the immunity, inoculated cattle require to be exposed to natural infection from about the twenty-first day after inoculation.

A percentage of the animals which react to inoculation and a still larger percentage of the non-reactors again react to East Coast fever on exposure, with some mortality; the death rate being greater amongst those which failed to react to inoculation.

The method can be made use of with the prospect of conferring immunity in about 75 per cent of recovered redwater anaplasmosis cattle other than calves.

Immunisation should be considered only as an emergency measure on infected farms where losses are occurring and dipping facilities do not exist. The only object is to save the greatest possible number of cattle under the worst conditions.

Immunisation of young calves was found still less satisfactory owing to the difficulty of obtaining a reaction to East Coast fever by inoculation consequent on the partial resistance possessed by young calves. In addition, the coexistence of other tick-borne diseases or a recurrence of such was found to be an adverse factor in the immunisation of calves. Inoculation of cattle susceptible to redwater and anaplasmosis and other tick-borne diseases is not recommended owing to the risk of transmission of these infections by the material (spleen, etc.) used for inoculation.

It was hoped that advantage could be taken of the partial resistance possessed by some unweaned calves of immunising them by infecting them by hand with infected ticks; it was found, however, that the immunity in young calves is in some cases at least built up by more than one attack, and that calves which reacted to infestation by hand and survived were not necessarily immune against reinfection.

Immunity in East Coast Fever.

Careful observations show that the immunity conferred in cattle which reccover from natural infection is, in the majority of cases, complete; but, exceptionally, a beast which has recovered from an original attack again contracts East Coast fever from the bites of infected ticks; in such the reaction is not severe.

In calves, the percentage of recovered animals which again contract natural infection would appear to be greater in comparison with weaned cattle. In the case of inoculated cattle, as stated above, a percentage of those which react to inoculation and a still larger percentage of those which do not react to inoculation contract East Coast fever when exposed to natural infection, and some again react on re-exposure.

In East Coast fever there are thus limitations to immunity in nature, but the limitations are greater in artificially immunised cattle.

Disease:
EAST COAST FEVER

Number: × 3091

Description:
BOVINE

Remarks:
E. C. F. TEMPERA-
TURE REACTION.

ANIMAL EXPOSED
TO NATURAL
INFECTION FROM
DEC. 27TH 1928.
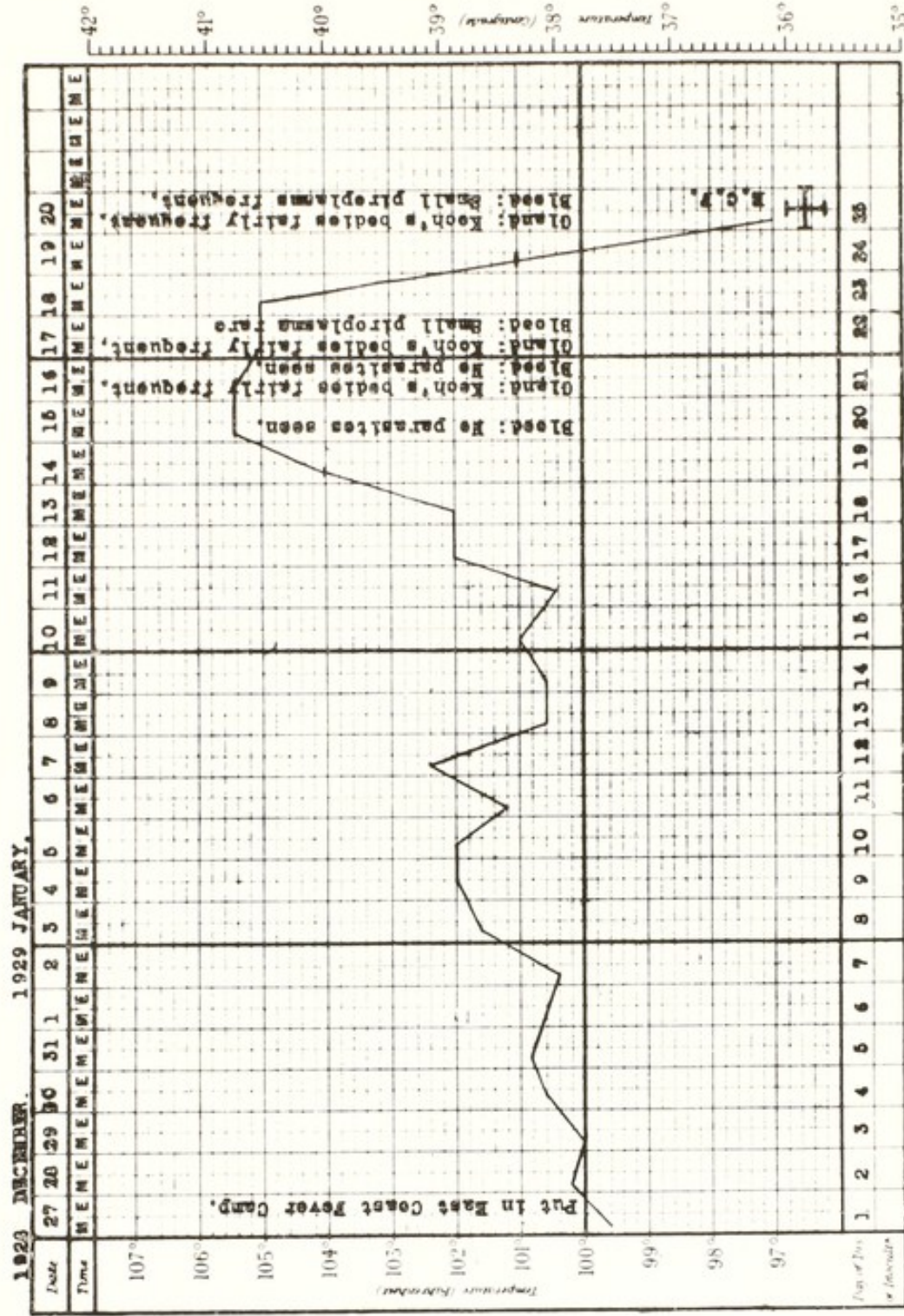
EAST COAST FEVER—TEMPERATURE REACTION.

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Cattle which recover from East Coast fever are not a known reservoir of infection. Ticks which engorge on a recovered beast do not become infected and are consequently not capable of transmitting the disease. Infected ticks which engorge on an immune beast clean themselves of infection.

CONTAGIOUS BOVINE PLEURO-PNEUMONIA (LUNG SICKNESS OF CATTLE).

A contagious disease, affecting chiefly the lungs and pleura.

Bovine pleuro-pneumonia is a disease of tropical, sub-tropical and temperate climates, but unlike many of the animal diseases which are met with in tropical countries it is not, comparatively speaking, new to science; indeed, it was definitely known to occur in parts of Europe as early as the sixteenth century. It subsequently spread throughout Europe and eventually to Great Britain and elsewhere, through the exportation of infected cattle, and then to various parts of the world.

In some parts of the African Continent, pleuro-pneumonia was eradicated by the slaughter of visibly affected, inoculation of the in-contacts, and quarantine of the herd for some months. In other countries, e.g. Great Britain, United States of America, and parts of Europe, this method proved unsuccessful, and it was not until the " stamping out " method, viz. slaughter of all affected and in contact, was enforced that complete eradication was effected.

It is known to be prevalent in some of the Native Reserves. It also occurs in the settled areas.

CAUSE.

The causal agent is a polymorphic organism; its morphology is microscopically distinguishable when cultivated on artificial media. The organism is scientifically known as *Asterococcus mycoides*.

INCUBATION PERIOD.

This varies, but symptoms may appear in from three to six weeks, with a minimum of ten days after contact with affected animals.

Fresh cases may occur for a considerable time after the first appearance of the disease in the herd.

Mode of Infection.

Infection is expelled in the air and particularly during the act of coughing, and enters the lungs with the inspired air; close contact is thus necessary for transmission of infection.

There is no evidence that the virus of bovine pleuro-pneumonia lives in the outer world as a saprophyte; indeed, observations in this Colony, extending over some years, show that infection disappears from the herd after the death of all infected animals, and that susceptible cattle in close contact with cattle reacting to inoculation, with virus escaping from the open lesions at the seat of inoculation, do not contract the disease.

Symptoms.

The disease may appear in a peracute, acute or subacute form.

In the peracute form, which is not as a rule met with, the pneumonia develops in from two to three days, and death occurs within two to three days later.

The acute is the common form. In the early stages the symptoms are not characteristic. There may be a rise of temperature, animal appears dull, with hair erect, and a dis-inclination to feed. Later, typical symptoms are visible, viz. a dry painful cough which subsequently becomes moist, respirations are laboured, expiration is carried out with grunt-ing, the animal is disinclined to move and stands with its elbows turned outwards and nose outstretched. There is usually in the later stages a muco-purulent discharge from the nose, and sometimes an œdematus infiltration of the tissues at the lower part of the chest and, maybe, extending along the abdomen. In the final stage emaciation is marked and the animal remains lying down.

In fatal cases, death occurs in from two to three weeks or more after the onset of symptoms. A large percentage of affected animals make a partial, and eventually a complete, recovery and regain condition, particularly if the grazing and weather conditions are good, but the virus may remain active in the affected portion of the lungs of such for some time after apparent recovery; in some instances up till at least twelve months after the appearance of symptoms, and the animal remains a source of infection—the so-called " lunger."

In the subacute form the symptoms are, as a rule, less marked, and may escape observation.

In young calves there is often a swelling of the joints.

Post-mortem Appearances.

These vary according to the character the disease assumes. In the commoner, viz. the acute form, sometimes both lungs are affected, but it is usual to find the lesions localised in only one lung; the affected portion of lung is raised above the surrounding, comparatively speaking, healthy portion and is solid in consistency; the chest cavity usually contains a varying amount of clear yellowish or slightly reddish-coloured liquid, containing flakes or strands of fibrin, which coagulates into a jelly-like mass on exposure.

The affected lung is fixed to the ribs by a fibrinous spongy-like mass, or in older cases by firm fibrous tissue. In some cases the chest cavity contains a lot of putrid-smelling fluid.

When the infected portion of the lung is incised it will be found divided up into various-sized light red, dark red and greyish areas, by the thickened interlobular septa and the dilated lymph spaces in the latter appear as round, oval or fissure-like depressions filled with lymph producing a beaded-like appearance. A clear yellow sero-fibrinous fluid, which coagulates on exposure, exudes from the cut surface of the affected lung. In more chronic cases the interlobular tissue consists of firm connective tissue, while the lobules lying between are necrotic and even calcified.

The mediastinum is often infiltrated with a yellowish exudate, and there is sometimes a spongy-like exudate on the heart sac and heart.

The spleen is sometimes enlarged and on section the pulp may have a sago-like appearance.

The virus sometimes extends, via the lymphatic vessels, to the abdominal cavity, resulting in a fibrous peritonitis and a fibrinous exudate on the diaphragm and anterior surface of the liver.

In young calves a sero-fibrinous inflammation of the joints is often observed.

In cattle which have recovered from the acute form it is usual to find the affected portion of lung surrounded by a thick fibrous capsule. The encapsuled portion, which varies in size

from a nut to a fist and even larger, is known as a " seques-trum "; this eventually becomes absorbed or undergoes abscess formation and putrefaction.

In many old cases the only evidence of pleuro-pneumonia is the thickened pleura and firm fibrous adhesions between the affected lung and chest wall, and the lung adjoining the site of infection shows an interstitial pneumonia which manifests itself in a thickening of the interstitial tissue and induration of the lung tissue.

MICROSCOPICAL EXAMINATION.

Diagnosis.—The histological lesions in bovine pleuro-pneumonia are specific and can be detected microscopically in stained sections of a portion of the affected lung. In cases where the diagnosis is in doubt, small pieces, about two inches square, of the affected lung should be collected and immediately put in formalin solution, a supply of which can be obtained from the Chief Veterinary Research Officer, Kabete, or the veterinary officer of the district, and forwarded to the Laboratory for examination.

CLINICAL DIAGNOSIS.

In the living animal it is often impossible to detect by clinical examination some at least of the affected animals, more particularly those which have recovered from the acute stage or in which the lesions are not extensive; such are usually described as " lungers," and since a percentage of such are a source of infection it is of fundamental importance for the control and eradication of the disease that they do not escape detection.

SERUM DIAGNOSIS.

During recent years, serum diagnosis methods have been introduced for detecting affected animals.

The practical value of the tests is reduced by the necessity of repeating the tests to exclude (1) animals which may be in the incubative period of the disease at the time of the original test, (2) animals which may have contracted the disease during the intervals between the tests; in addition, some healthy cattle give a positive (non-specific) reaction.

TREATMENT.

Curative treatment is of little or no assistance. Spon-taneous recovery occurs in a fairly large percentage, if the weather conditions are favourable and sick cattle have not to travel long distances for food and water.

SECTION OF PLEURO-PNEUMONIA LUNG SHOWING
THE THICKENED AND BEADED-LIKE APPEARANCE
OF THE INTERLOBULAR SEPTA.

Preventive inoculation is largely resorted to in this Colony. It consists of inoculation of a pure culture virus into the sub-cutaneous tissues of the tail. Vaccines of different virulency are prepared at the Laboratory for issue.

The virulency of a pure culture vaccine decreases after a number of sub-cultures; at about the twenty-fifth generation it produces little or no mortality, whereas the reactions which occur from the original culture and early sub-cultures of the same strain of virus are sometimes severe and difficult to control, and some mortality may be experienced; the use of the more virulent vaccine is not recommended in herds in which the disease does not actually exist. Previous to the introduction of the pure culture vaccine, the sero-fibrinous exudate (lymph virus) collected from the lung or pleural cavity of an affected beast was used for preventive inoculation, but owing to the losses which sometimes followed its use and the difficulty of maintaining supplies, the pure culture vaccine, when laboratory facilities exist for its preparation, is now substituted for the lymph virus.

The following method of obtaining supplies is sometimes resorted to where laboratory facilities do not exist for preparing the pure culture vaccine or it is difficult to obtain lymph virus from a naturally affected beast, viz. a susceptible young beast is inoculated behind the shoulder with a pure culture virus, and this is maintained by passage through susceptible young cattle. When lymph is required a reacting beast is slaughtered and the virus collected and preserved in glycerine; one cubic centimetre of the glycerinated virus being inoculated into the subcutaneous tissues of the tip of the tail.

This method necessitates supplies of large numbers of susceptible cattle, if large quantities of virus are required. The method is costly; in some cases little lymph is obtained from the reacting beast, moreover the virus is likely to produce marked reactions and some mortality occurs when used in the practice.

DIRECTIONS FOR THE USE OF PLEURO-PNEUMONIA (PURE CULTURE) VACCINE.

Dose and Properties.—The dose is 1 c.c.

The vaccine is a pure culture of the organism of bovine pleuro-pneumonia in beef bouillon, Martin's peptone additioned with ox serum.

It has a more or less yellowish colour and a cloudy appearance. It should have no offensive odour.

The bouillon peptone Martin ox serum is a favourable medium for the growth of other organisms, hence once a bottle has been opened the contents should be used the same day.

The vaccine does not retain its virulency for any considerable period, particularly if exposed to light. It should be kept in a cool place, protected as far as possible from light until used.

The label on each bottle states up to what date the vaccine may be used.

Instruments, etc., necessary for Inoculation :—

1. A 10 or 20 c.c. hypodermic syringe. The syringe should be graduated in cubic centimetres, with a revolving wheel on the piston-rod to regulate the size of the dose.

2. Some extra hypodermic needles to fit the nozzle of the syringe.

3. Some pieces of pull-through metal wire for freeing the inside of the needle from any obstruction.

4. A small receptacle for holding the vaccine from which the syringe is filled. This should be kept covered and protected from dust, etc., to avoid contamination of the vaccine.

5. A sterilizing vessel.

6. A pair of forceps for removing syringes, needles, etc., from the sterilizer.

A spare syringe, needles and receptacle will avoid loss of time in sterilization during operations.

Sterilization of Syringes, etc.—Complete sterilization of the above-mentioned instruments, etc., should be carried out before commencing operations. This is effected by boiling them for at least five minutes. It is important before commencing inoculation to see that the syringe works well. This should be tested by sucking up into the syringe by means of the piston some of the boiled water and ejecting it once or twice. If after sucking up the water the barrel of the syringe is not completely filled the screw at the base of the piston needs tightening, but if the piston works too lightly this may be slightly loosened.

The danger of carrying from animal to animal, with the needle, infections which may exist in animals at the time of inoculation and which may escape observation, viz. anthrax.

blackquarter, etc., should enter into consideration; as a pre-cautionary measure, instruments and receptacles should be sterilized frequently during operations.

Operation and Effects of Inoculation.—The site of the original inoculation should be three to four inches from the tip of the tail.

The hair should be clipped off the site and the skin washed with an antiseptic such as 5 per cent Jeyes' fluid or 2 per cent lysol. The needles should be pushed from above downwards through the skin of the upper surface of the tail into the subcutaneous tissues about three or four inches from the tip, and then slowly withdrawn to form a pocket. The vaccine is then injected slowly under pressure. Some of the liquid will ooze through the opening of the skin when the needle is withdrawn— a sure indication that some of the vaccine remains. In cattle which react there is some heat tenderness and a swelling at the seat of inoculation. The reaction usually commences about the eighth day, and some-times not before about the third week, after inoculation. The reaction varies in size, and may be distinguished by passing the hand down the tail over the site of inoculation. Sometimes an increase in size of one or both anal lymphatic glands, which are situated on either side of the root of the tail, may occur, but one or both of the latter may be increased in size at time of inoculation, in which case it is recommended to hair-brand the overlying skin so as to be able to distinguish it from a swelling which results from inoculation.

Tails of inoculated animals should be examined from the eighth day. Animals which show a doubtful or no reaction should be re-examined at intervals up till at least the twenty-first day.

Non-reactors to the original tail inoculation should be re-inoculated in the tail on the twenty-first day after the date of the original inoculation, and tails examined on the eighth day and at intervals up till at least the twenty-first day.

The following observations have been made :—

1. A susceptible animal may be refractory to an original inoculation but may react when re-inoculated.

2. A susceptible animal may possess a natural resistance and not react.

3. An animal may be in the incubative stage of the disease and yet react and the disease continue its evolution

Treatment of Inoculated Animals.

Animals which react to the tail inoculation usually do not require treatment. In cases where the reaction shows a tendency to extend upward to the root of the tail, it is recommended to cauterise the tissues around the tail with a hot iron a few inches above the upper limits of the swelling.

Immunity.

The vaccine will not protect animals that have already contracted the disease or those which are in the incubative stage of the disease, and it is not expected that immunity will be conferred in non-infected cattle until after the end of the reaction.

This means that cases may continue to occur for some weeks after completion of inoculation.

Susceptible animals may continue to contract infection the longer immunisation is delayed and they remain in contact with affected animals.

Warning.—In dealing with an infected herd it is of fundamental importance that all visibly infected animals be segregated without delay and all in-contacts inoculated at once. The tail should not be unduly pulled at the time of inoculation. Surgical operations should not be carried out—castration, bleeding, etc. Work cattle should not be worked if reacting severely to inoculation.

Every care is taken in the preparation of the culture, but no guarantee is given regarding its safety and efficiency.

Inoculation " behind the shoulder," subsequent to the tail inoculation is sometimes carried out, e.g. in case of outbreaks and when an owner wishes his cattle " M.P." branded, but as a general procedure " behind the shoulder " inoculation is not recommended owing to the risk of severe reactions and some mortality occurring.

REDWATER.

This disease is prevalent throughout the Colony, but on some estates, where the cattle are dipped regularly at short intervals from or shortly after birth, a percentage of the cattle born and reared thereon escape infection, and there is a risk of severe losses occurring if the latter are moved to a redwater-infected area.

Different strains of redwater have not been recorded as occurring in this Colony, but it is known that such do exist in South Africa, where cattle which are resistant to the strain of virus existing in one part become reinfected when moved to where a more virulent strain exists.

Redwater affects all classes and ages of cattle. Cattle born and reared on redwater-infected farms in this Colony contract the disease during early life. Young calves, particularly those reared under ranching conditions, usually pass through a mild attack and recover without treatment. The resistance against redwater in calves born and reared on dairy farms is lower and some mortality may result therefrom.

Animals which recover from redwater possess a resistance, but recurrences are sometimes observed in cattle when inoculated with blood containing multiplying forms of the parasite, and also in cattle exposed to a heavy infestation with infected ticks.

A recurrence of the disease may also occur in recovered animals, e.g. when the vitality is lowered by rinderpest, East Coast fever and other diseases, and by other causes such as fatigue due to overwork, after a long train journey, cold, etc.

CAUSE.

The redwater of this Colony is caused by a minute protozoal parasite technically known as *Babesia bigeminum*, which gains entrance to the body through the bite of an infected tick, and after undergoing development therein invades the red blood cells, which are broken down and the contained hæmoglobin liberated and excreted through the kidneys, giving a reddish colour to the urine; hence the name, " redwater " or " hæmoglobinurea."

The parasite can be detected microscopically in blood smears of cattle reacting to the disease; it is the exception to find redwater parasites on microscopical examination of blood of a recovered animal, although the blood will produce redwater if inoculated to a susceptible beast. If a beast is constantly exposed to tick infection its blood remains virulent, but if the animal be removed to a tick-free area the infection may, after a *varying period*, disappear; instances have been recorded where the blood was infective twelve years after the beast had been removed from the infected area. On the other hand, the blood of a recovered beast which had been kept at Kabete for approximately two years in a tick-free stable failed to transmit redwater.

INCUBATION PERIOD.

The incubation period of the disease when contracted naturally is about seventeen days; the incubation period after inoculation of redwater blood is shorter and varies from five to fifteen days; exceptionally twenty days.

SYMPTOMS.

The temperature rises suddenly to 105° F., or higher, and remains elevated; in fatal cases it usually falls to subnormal before death; in the early stages there is dullness, disinclination to feed and a staring coat, and usually constipation, later diarrhœa; in some cases œdema of the lungs sets in, with accompanying symptoms of distressed respirations; in the later stages, coma and delirium are sometimes seen, and the animal is likely to charge anyone close at hand. The urine may be claret-coloured or dark red in the early stages, or not until the fifth or sixth day of the temperature reaction, depending on the invasion and destruction of the red cells. It is usual to find the visible mucous membrane yellowish in colour owing to the presence of bile in the circulation.

POST-MORTEM APPEARANCES.

In the acute cases there is often an œdema of the lung, with froth in the air passages and at the nostrils. The interlobular tissue is sometimes infiltrated with a yellowish fluid which gives a resemblance to yellowish veins in the lung.

The heart sac may contain an excess of fluid.

The heart usually shows hæmorrhages on its external surface and on the lining membrane of the heart cavities; there may be a gelatinous infiltration at the base of the heart.

The spleen is considerably enlarged and its pulp soft and dark in colour.

The liver is enlarged and congested, usually of a uniform yellowish colour (icterus). The gall-bladder is distended and the bile thick in consistency.

Kidneys.—The fatty capsule is sometimes infiltrated with a gelatinous exudate and the kidneys congested.

The fourth stomach.—The mucous membrane claret-coloured, with hæmorrhages on its surface.

Intestines frequently show inflammation in the form of stripes and patches or hæmorrhagic spots.

Subcutaneous tissues, serous membranes and visible mucous membrane have usually a yellowish appearance.

The muscular tissue may be pale and flabby in appearance.

The bladder contains claret-coloured or dark-brown urine.

In protracted cases the blood is pale and watery and the visible mucous membrane pale and carcass emaciated (anæmia).

Preventive Measures.

Preventive Inoculation.

Since the same ticks which transmit redwater also transmit anaplasmosis, it is usual to find the two diseases closely associated, and where immunisation is indicated against one it is usually also necessary against the other.

Redwater and anaplasmosis vaccine for the immunisation of cattle against the above diseases is now obtainable on application to the Chief Veterinary Research Officer, Kabete, from whom full particulars and directions for use can be obtained.

Its use is indicated in the case of cattle born and reared on estates where redwater and anaplasmosis do not exist or where the incidence of these diseases is low.

As stated above, heavy losses are likely to occur if regularly dipped cattle are removed to an infected area, and it is recommended that they be immunised prior to removal. Experience has shown that calves reared under ranching conditions may be inoculated at birth with the blood of a naturally recovered redwater-gallsickness beast without any ill-effects, and advantage could be taken of this to immunise such.

Imported cattle should be immunised before being exposed to tick infection, and should be railed on arrival in the Colony to the Veterinary Quarantine Station, Mile 1/16, Thika railway, near Nairobi, where facilities exist for off-loading the cattle and for immunisation under veterinary supervision.

Dipping.

The common carriers, viz. *Rhip. decoloratus* and *Rhip. australis*, popularly known as the "blue tick," are one-host ticks. They attach as larvæ and moult on the same animal into nymphs; the nymphs moult on the same animal into adults. The male and female adults mate on the beast, and then engorge and drop. The period which elapses from time of attachment of the larvæ till the adults drop is from three

to four weeks. Hence one dipping every three weeks suffices
to destroy the blue ticks which have attached to a beast.
The larval blue ticks can live for about eight months without
a host. If the farm is well stocked and dipping regularly
carried out, the greater number of the blue ticks which exist
on the grazing should have been collected by the cattle in
eight months' time and destroyed by dipping; any larvæ which
failed to find a host in eight months would have died. The
blue tick has been found on equines, sheep, goats and dogs,
and it is necessary that they should also be included in the
dipping operations where its eradication is desired; but, in
addition to the above, game and vermin are hosts of the
blue tick, and maintain infestation of the grazing if they
exist thereon.

Infection passes through the egg of the blue tick. The
progeny of adult female blue ticks which fed on recovered
cattle are thus capable of transmitting redwater.

The exceptional carriers of redwater, viz. the brown tick
(*Rhip. appendiculatus*) and the red-legged tick (*Rhip. evertsi*),
do not complete their cycle on the one host; the latter is a
two-host tick.

The common carriers, viz. *Boophilus coloratus* and
Boophilus australis, are easily destroyed on the host, whereas
the brown tick and the red tick, owing to the site of attach-
ment on the body (in the case of the brown tick inside the
ears, eyelids, under tail, tuft of tail, prepuce in males, and in
the case of the larvæ and nymphs of the red-legged ticks inside
the ear and the adults under the tail, etc.) are more or less
protected and escape destruction by the dipping fluid unless
hand-dressing is combined with dipping. A recovered red-
water beast, if its blood is still infective, is capable of infecting
ticks which engorge on it; whereas in the case of East Coast
fever, ticks which engorge on a naturally recovered beast are
not infective. The same ticks which transmit anaplasmosis
are usually capable of transmitting both redwater and ana-
plasmosis.

An observation made by the writer showed that on farms
where short-interval dipping (three to five days), combined
with thorough hand-dressing, is carried out from or shortly
after birth, some at least of the cattle born and reared thereon
escape redwater and anaplasmosis; whereas on farms where
dipping at seven days' intervals *not* combined with hand-
dressing is resorted to, a large percentage escape redwater and

anaplasmosis; the explanation possibly being that on the former the common carriers of redwater and anaplasmosis (blue ticks), as well as the exceptional carriers, viz. the brown and red-legged tick, are destroyed by the short-interval dipping combined with hand-dressing; on the latter the common carriers (blue tick) are destroyed, but since hand-dressing is not carried out, a percentage of the exceptional carriers escape destruction and are responsible for the transmission of redwater and anaplasmosis.

On an estate in the drier parts of the Colony, where short-interval dipping (three days) not combined with hand-dressing has been regularly carried out for some years, it is the rule to find the young cattle born and reared thereon susceptible to redwater, and a large percentage to anaplasmosis.

TREATMENT.

Redwater is curable; if the disease is not too far advanced a subcutaneous injection of a solution of trypanblue is usually effective.

ANAPLASMOSIS OR GENUINE GALLSICKNESS.

This disease occurs in districts where redwater is met with. It affects all types of cattle; country-bred cattle contract the disease when young.

Imported European cattle are highly susceptible. A percentage of cattle reared on farms where dipping is regularly carried out from or shortly after birth may escape infection.

It is a tick-borne disease with a specific causal organism. It has sometimes been confused with other tick-borne diseases such as redwater, trypanosomiasis, spirillosis, etc., but may microscopically be differentiated from these.

The term gallsickness is sometimes applied to disorders arising from digestive disturbances due to various causes, including plant poisoning.

CAUSE.

The causal organism is a small blood parasite which be detected microscopically in blood smears of an affected animal. The parasites may occur chiefly on the margin or in the centre of the red cells. In the former case, the disease is known as anaplasma maginale; in the latter, as anaplasma centrale. It is the exception to find cases of anaplasma centrale occurring under natural conditions.

Incubation Period.

In cases of natural infection, the incubation period varies from fifty-five to one hundred days, or thereabouts. The incubation period after inoculation of infected blood is from seventeen to fifty-five days or thereabouts; average period, thirty-odd days.

Symptoms.

Cattle born in infected areas contract infection early in life, and it is usual to find them showing symptoms during the third month of calfhood; in calves reared under ranching conditions the percentage of mortality is small, but in calves reared on dairy farms anaplasmosis is responsible for some mortality.

The symptoms in many respects resemble those of red-water, except that there is an absence of red urine. The first indication is a gradual or sudden rise of temperature, animal appears dull, coat staring, and disinclination to feed. In the early stages there is usually constipation and later diarrhœa; if œdema of the lungs sets in, there is disturbance of the respirations, and in fatal cases froth is sometimes found at the nostrils. The visible mucous membranes and skin may have a yellowish colour; in cases which survive the acute stage it is usual to find anæmia, which manifests itself in a paleness of the visible mucous membranes, viz. of the eyes, lips, gums, and of the vulva in females; the tongue is usually notably white.

Death may occur in the acute stage, but some of the animals which survive this die later of the *sequelæ*, viz. anæmia and cachexia. In dairy-reared calves the disease is frequently complicated with paratyphoid and other bowel infections, which may be normally present in the bowels of healthy animals, but become pathogenic in consequence of the digestive disturbances and pathological lesions induced by the anaplasma infection.

Post-mortem Appearances.

A characteristic appearance is a jaundiced (yellowish) condition of the tissues. In protracted cases the carcass is emaciated, flesh pale and blood watery.

The heart itself may show on its external surface small hæmorrhages and the lining of the cavities hæmorrhagic patches or stripes.

The heart sac may contain an excess of fluid.

The lungs are sometimes œdematous, and a frothy fluid exudes from the cut surface, in which case it is usual to find froth in the bronchi and windpipe, and sometimes at the nostrils.

The chest cavity sometimes contains an increase of fluid.

Liver is enlarged and usually of a yellowish colour.

The gall-bladder is frequently distended with thickened bile.

Kidneys are usually congested, and if jaundice is present they are more or less yellowish in colour on section.

The spleen is also usually much enlarged and the pulp soft in consistency.

The lesions in the *fourth stomach and intestines* vary in intensity. The fourth stomach may show hæmorrhagic points and the intestines contain a good deal of mucus; in other instances the changes in the fourth stomach and intestines may be markedly pronounced and acute inflammation may be present.

The lymphatic glands are as a rule enlarged and œdematous.

The urine is usually pale in colour.

TREATMENT.

There is no known specific for the curative treatment of anaplasmosis; when constipation is present a pint of raw linseed oil and in addition thirty grains of calomel is sometimes administered to a full-grown beast. An ounce of epsom salts given in the drinking water daily is of assistance in overcoming constipation. To what extent this treatment is successful as a curative is difficult to say, as we are aware that a certain number of animals recover without any medicinal treatment.

Sick animals should be kept under shelter, protected from sun and rain, and given green and sloppy food.

PREVENTIVE MEASURES.

Dipping.—Anaplasmosis is transmitted by the same species of ticks which transmit redwater, viz. the blue ticks, the brown tick (*Rhip. appendiculatus*), the red-legged tick (*Rhip. evertsi*); the black pitted tick (*Rhip simus*) has also been proved to be a carrier.

Since it is usual to find that cattle recovered from ana-plasmosis are also recovered redwater beasts, the same tick is usually capable of transmitting both infections.

Ticks of the above species which engorge on a recovered redwater-gallsickness beast become infected and transmit in-fection in a later stage of their cycle.

As stated above, under " Redwater," the blue tick is a one-host tick; the period of attachment is about three to four weeks. The destruction of blue ticks on the host is effected by dipping at either three, five, seven or fourteen days' in-tervals, or within the period it remains attached. The brown tick and the black pitted tick are three-host ticks; to prevent their dropping engorged from recovered redwater-gallsickness cattle, three- or five-days' dipping combined with hand-dressing should be carried out. The red-legged tick (*Rhip. evertsi*) is a two-host tick. The larva attaches and moults on the host into a nymph; the latter after engorging drops and moults on the ground into an adult which seeks a new host. Infection is transmitted by the adult red-legged tick after it has fed in its larval and nymphal stage on a recovered gallsickness beast. The larval and nymphal stage of the red-legged tick remains on the host for about ten days, hence dipping within this period would effect their destruction before they dropped engorged. In practice, three or five days' interval dipping is usually carried out in this Colony, and if combined with thorough hand-dressing no anaplasma-infected ticks should escape from hosts dipped at these intervals.

Preventive Inoculation (Immunisation).—This should be carried out when there is a possibility, owing to dipping, of the cattle escaping infection, particularly if it is the intention to move cattle, born and reared on a farm where dipping is regularly carried out, to an infected area. A vaccine which should protect against a severe reaction to gallsickness (ana-plasma marginale) transmitted by ticks is obtainable on appli-cation to the Chief Veterinary Research Officer, Kabete, from whom full particulars can be obtained. In the case of regularly dipped calves reared under ranching conditions, inoculation at birth or shortly after with blood of a known recovered redwater-gallsickness beast could be carried out. Calves reared on dairy farms are less resistant to disease, and owners are recom-mended to communicate with the Chief Veterinary Research Officer before inoculating such with anaplasmosis blood.

ANTHRAX.

This disease is due to the bacillus *anthracis*, which gains entrance to the blood-stream and causes a fatal septicæmia. It is widely prevalent in this Colony, and is undoubtedly spreading as the result of the indiscriminate opening of carcasses of bovines and other animals which have died suddenly, and by the unrestricted movements of hides by natives. Carnivorous birds, by feeding on anthrax flesh, also disseminate the disease, as spores of the anthrax bacilli are capable of passing undigested through the stomach and intestines and reaching the ground in the fæces, where they rapidly proliferate.

Once infection appears on a farm it is doubtful whether it will ever be eradicated by present means, as it has been shown in America that growing plants and grasses are capable of bringing anthrax spores to the surface from underlying deeply buried carcasses. It is thus obvious that on farms where anthrax has once occurred annual vaccination should be carried out as a routine, and no carcass opened until anthrax has been eliminated as the cause of death.

CAUSE.

The cause is a specific bacillus which is pathogenic for all the domestic animals and man. Wild ruminants are also susceptible, and elephants die from the disease. Birds are highly resistant, but fatal cases have been reported from South Africa in the ostrich. Cold-blooded animals are immune.

In the blood-stream the organism exists as bacilli, but as soon as blood is spilt and exposed to the air spores are formed which are exceedingly resistant to ordinary disinfectants. It is by these spores that infection is maintained on a farm, and it is known that spores may remain viable in the ground for many years.

SOURCES OF INFECTION.

Undoubtedly the commonest route of infection is by the ingestion of food and water containing the spores or mature organisms. Certain proprietary cattle cakes contain the spores but in the majority of cases in this country cattle are infected by eating or drinking food and water contaminated by the specific organism. It is known that biting flies (*stomoxyes*) are capable of transmitting this disease to cattle and horses in South Africa, but it is not known if this means of transmission exists in this Colony. In man, anthrax generally

gains access to the body through cuts or abrasions on the skin, giving rise to the condition known as " malignant pustule."

INCUBATION PERIOD.

This varies considerably. It may be only a few hours up to several days.

SYMPTOMS.

The disease may run such a rapid course that no clinical symptoms are noticed, and the animal is found dead. Sudden death in any of the domestic animals is always suggestive of this disease, and ought always to be excluded before a carcass is opened for examination.

Different animals present different symptoms, but these generally affect the throat region or the gastro-intestinal tract.

(*a*) In the horse.—It is unusual not to notice any symptoms, which are those of high fever, violent and continuous colic, and a painful œdematus swelling of the throat region followed by death. The throat swelling may be very severe, and lead to symptoms of asphyxia. Death results from anthrax septicæmia, though in some cases it is undoubtedly due to asphyxia.

(*b*) In the Ox.—No symptoms may be observed and the animal is found dead. In other cases there is very high fever, an acute enteritis, and very often delirium. Death is very rapid and may be preceded by sudden collapse.

(*c*) In the Sheep.—Very few symptoms have ever been seen in this animal as the course is very rapid and death very sudden.

(*d*) In the Pig and Dog.—Throat symptoms are very noticeable in both animals, but in the pig the course of the disease is not so acute as in the other animals, and both fever and clinical symptoms may last some days.

DIAGNOSIS.

This is, as a rule, easy on account of the sudden death, the issue of blood-tinged fluid from the nostrils, anus and sexual organs, and the great distention of the carcass. The throat swelling is also very significant, but it may be confused with the swellings found in cases of snake-bite and quarter-evil. Most cases of so-called snake-bite in this Colony are nothing more than the throat form of anthrax, though when

the limbs are affected the disease is undoubtedly quarter-evil. A positive diagnosis can always be made from microscopic examination of the blood or fluid from the throat lesion.

Post-mortem Lesions.

Under no circumstances should an anthrax carcass be opened for post-mortem examination, and the same may be said of an animal suspected of dying from the disease. As soon as anthrax blood is spilt and exposed to the air spores are rapidly formed and are capable of living in the soil for many years. Another point is that the opening of an anthrax carcass is a dangerous procedure for human beings as man is susceptible to this disease and readily succumbs to it.

Should a carcass be inadvertently opened the following lesions will be seen, viz. an enormous soft dark spleen which greatly resembles a blood clot; pronounced congestion of the lungs, liver and kidneys; hæmorrhages under the lining of the heart; and very great distention of all subcutaneous vessels. In many cases there is a marked straw-coloured infiltration of the tissues in the neighbourhood of the throat.

Treatment and Control.

Treatment is entirely preventative and consists of the thorough destruction of all carcasses and blood-stained discharges. Whenever possible, this should be done by burning, but the alternative is to bury the carcass deep and liberally treat with lime. Care should be taken that such carcasses are not likely to pollute the water supply, and it is always advisable that such anthrax graves be covered with a thorn boma or fenced off to prevent cattle grazing over them. Should the animal have died in a stable, all litter and fodder should be burnt and all fittings, utensils, etc., thoroughly disinfected. Whitewashing the walls and floors is recommended by many authorities.

In some countries, e.g. Great Britain, the above-mentioned precautions are sufficient to control the disease, but in this country where anthrax is enzootic and undoubtedly spreading, preventative inoculation is advised, as it is undoubtedly the most efficacious measure there is of controlling the disease. At present a double inoculation is employed, but it is anticipated that a single spore vaccine will be available in the near future.

Directions for the Use of Double Anthrax Vaccine.

Dose.—For cattle, $\frac{1}{2}$ c.c.; for horses, mules, donkeys, sheep, goats and pigs, $\frac{1}{4}$ c.c.

(1) The vaccine should be used as soon as possible after it is received.

(2) Two separate vaccinations must be performed on each animal and two different vaccines are employed, with an interval of from twelve to fourteen days between the first and second vaccination.

(3) The tubes are marked '' First of double '' (white label) and '' Second of double '' (red label).

(4) The price is 30 cents per dose for first and second vaccination.

(5) *Instruments necessary for the operation.*—A hypodermic syringe, with a few hypodermic needles to fit the nozzle of the syringe. The syringe must be graduated with a revolving wheel on the piston-rod to act as a stop and regulate the size of the dose to be injected.

When obtainable, a syringe of a capacity of 1 or 2 c.c., graduated in eighths or quarters is convenient for use, as with such a syringe the vaccine can be injected directly without dilution.

In case, however, a syringe of the above size is not available, then a larger one, as, for example, one of 10 c.c. capacity, can also be employed. With such a syringe, no difficulty may be met with in injecting a dose of $\frac{1}{2}$ c.c. If, however, difficulty should be experienced in accurately measuring on the piston-rod the dose of $\frac{1}{2}$ or $\frac{1}{4}$ c.c., then it is possible to overcome this by diluting the vaccine with sterilized water at the time of the operation in such a way as to make a mixture the dose of which is 1 c.c.

To do this means that the vaccine will have to be diluted with an equal quantity of sterilized water where cattle are to be injected, and in the proportions of one part of vaccine to three parts of sterilized water where horses, mules, donkeys, or pigs are concerned.

The water used for dilution must be water that has been boiled for at least five minutes, and then allowed to become cold in the vessel in which it was boiled, while the receptacle necessary for mixing the vaccine and sterilized water must have been sterilized in the manner indicated.

If a 10-c.c. syringe is used, the dilution is performed as follows, where cattle are to be injected :—

Take the syringe previously sterilized, suck up into it 5 c.c. of the vaccine, and eject this into the sterilized mixing receptacle.

Next suck up into the syringe 5 c.c. sterilized water and eject this in turn into the receptacle already containing the vaccine.

Finally, ensure that the vaccine and water are thoroughly mixed by sucking up the liquid in the receptacle into the syringe, and ejecting it back again, repeating this two or three times.

This operation performed, the mixture is finally drawn up into the syringe and is now ready for injection into cattle in the dose of 1 c.c.

If horses, mules, donkeys, sheep, goats and pigs are to be injected, the general procedure to be followed is similar to the above, but the quantities with which the dilution must be made will necessarily differ and must in this case be $2\frac{1}{2}$ c.c. of vaccine for every $7\frac{1}{2}$ c.c. of sterilized water.

(6) The dose for a young animal is the same as a dose for a full-grown animal.

(7) *Sterilization of Instruments.*—This should be performed very thoroughly.

(8) *Operation.*—Sheep and pigs are best vaccinated on the inside of the thigh; cattle, horses, and mules, behind the shoulder or on the neck. Working animals should be vaccinated in a place where the harness will not chafe.

Clip the hair from a patch about the size of your hand and wash this part thoroughly with a $2\frac{1}{2}$ per cent carbolic acid solution (about two teaspoonfuls of the liquid carbolic acid to a half-pint of water) or some other antiseptic. Take the syringe with needle fitted on its nozzle, shake well the tube of vaccine, and see that the vaccine in the tube is thoroughly mixed; remove the cork from the tube and suck up the vaccine into the syringe. Now set the wheel on the piston-rod to the figure indicating the size of the dose. Insert the point of the needle through the skin and push the needle right under the skin (not into the flesh), then press on the piston of the syringe until it is stopped by the wheel on the piston-rod. You will then have injected one dose. Withdraw the needle and syringe together, pressing at the same time firmly with the finger on the puncture of the skin. If any doubt exists that an animal has not received the correct dose, the operation may be repeated immediately.

(9) From twelve to eighteen days after the first vaccination a second vaccination must be performed in a precisely similar manner, this time using the second injection vaccine.

The second injection should be made on the opposite side of the animal to that on which the first injection was made; if the first injection was made behind the right shoulder the second injection should be made behind the left shoulder.

(10) Never use the second vaccine before the first. Female animals in advanced pregnancy (heavy in young) should not be vaccinated.

(11) As a general rule, sucking calves and foals need not be vaccinated, their mode of life not leaving them so liable to infection as weaned animals; but if it is noticed that the disease attacks such animals, and it is thought advisable to inoculate them, they can be done with half the dose for an adult, and as soon as they are weaned they should again be inoculated with a full dose.

(12) When a tube of vaccine has been opened, any that is not used should at once be destroyed.

(13) The vaccination of stock against anthrax on a farm where the disease has not already appeared is not advised, save in those cases where the local conditions render the introduction of the disease extremely probable.

(14) Working animals should be allowed to rest for a few days following inoculation, and may again be used, except they show a marked reaction to the inoculation and appear visibly ill. In the latter case, which is an exceptional occurrence, they must be treated as sick animals, and not put to work until fully recovered from the reaction.

(15) No danger is anticipated from the use of milk of vaccinated animals, save in such exceptional cases which may occur where the animals show a marked reaction to the inoculation, with signs of being visibly ill and a marked diminution in the yield of milk; in these cases the milk should not be used until the animal has completely recovered from the reaction.

(16) It is also not anticipated that any ill results will ensue from the consumption by human beings of the meat of animals that have been vaccinated, provided that the animal has shown no marked symptoms of illness following vaccination, and that no signs of the disease are apparent on post-mortem examination.

(17) The vaccination will not cure animals that have already contracted the disease, and it is not expected that immunity will be conferred until about fifteen days after the second vaccination. This means that death due to naturally acquired infection may continue to occur up to about a month from the second injection, as the incubation period of the disease varies from one to fourteen days.

(18) In the majority of cases vaccination is expected to protect animals against natural contraction of the disease from nine to eleven months, and it is recommended that stock be again inoculated at the end of that time. In some cases, however, the protection given does not last for such a long period, and re-inoculation may have to be performed at an early date. To such cases the following section on the nature of the immunity particularly refers.

(19) *Nature of Immunity.*—With regard to the immunity produced by the vaccine, it has to be pointed out that whilst the vaccine gives excellent general results it is not to be regarded as an infallible agent in conferring protection against the disease, and it is a recognised possibility that in certain cases animals subsequent to having been inoculated may naturally contract the disease and sometimes die as a result.

These breakdowns in immunity may depend on one or more of several circumstances, the more apparent of which are :—

(a) That as the dose of vaccine is small, certain animals may not receive the full dose of material, this depending on the care with which the inoculation is performed.

(b) That in some localities there apparently exists an excessively heavy infection of the veld or a local strain of anthrax of a higher degree of virulence than usual.

(c) That certain animals may resist ordinary attempts at immunisation.

(d) That certain animals are individually exceptionally susceptible to the disease.

It has been found, however, in previous cases where breakdowns in immunity have occurred, that the re-inoculation of the remaining animals with a double quantity of the vaccine has general given the result desired ,and hence this procedure is recommended in further occurrences of a similar nature.

(20) *Warning*.—Owing to the danger of carrying infection to healthy animals by means of the inoculating needle, any animal showing signs of sickness should not be vaccinated until all healthy animals have been first injected.

(21) *Note*.—In herds or flocks where infection is already present, a measure which is recommended in addition to the vaccination is the movement of the stock from the portion of the farm where the infection has been acquired to another part of the same farm believed to be clean or less infected.

The movement to have full value should be carried out immediately following inoculations (after the first inoculation where double vaccine is used), and subsequent movement of the stock back again to the infected portion, if desired, is not recommended until a period of about four weeks from the time of completion of vaccination (after the second inoculation, where double vaccine is used) has elapsed.

(22) Every care is taken in the preparation of anthrax vaccine, and each batch is tested before issue, but no guarantee is given regarding its safety and efficacy.

It is anticipated that anthrax spore vaccine (single injection) will be available for use in cattle, sheep and other domesticated animals; directions for which will be issued with the vaccine.

BLACKQUARTER OR QUARTER EVIL.

This disease primarily affects cattle and sheep. It occurs throughout this Colony, and infection is far heavier and more virulent than was formerly supposed. Cattle between the ages of six months and four years are most susceptible, but on many farms young calves and animals over four years are often affected.

Sheep of all ages may contract the disease, but so far there is no authentic case of this disease in sheep in this Colony. Horses, dogs and man are immune, but cases in swine have been reported from America.

Blackleg is most prevalent in mountainous country, and in valleys with swampy pastures ,especially if they are exposed to periodic inundations. It is seasonal in its appearance, being most prevalent in hot weather.

Cause.

Blackleg is due to a specific organism which exists in the soil, where it can thrive for many years. It is an anærobe, i.e. it is capable of propagating in the absence of air or oxygen. Infection generally occurs through the alimentary canal as a result of ingestion of food or water containing the organism, but in some cases the organism enters the body through skin wounds or abrasions. This is undoubtedly the case in sheep, where infection occurs through wounds caused by clipping or shearing.

Period of Incubation.

This varies from two to five days. The course of the disease is very acute, and lasts on the average twelve to forty-eight hours. In adult cattle it may last as long as a week.

Symptoms.

None may be noticed at all, and the animal is found dead, as in anthrax. Generally, as a rule, the animal is dull, ceases to feed and ruminate, and stands apart from the others with its head depressed. Respirations are accelerated, and when forced to move the animal is noticed to be very lame. There is a very pronounced rise of temperature. Examination of the lame leg shows a marked swelling of the upper portion of the limb. This swelling is very hot, painful, and crepitates or crackles on manipulation. It tends to spread very rapidly, and later becomes cold and painless.

As the disease progresses the symptoms become very pronounced; there is grunting and grinding of the teeth, great prostration and very marked lameness due to the rapid extension of the muscle-swelling. Death occurs suddenly, and may be preceded by a blood-stained discharge from the bowels and nose.

In sheep, the disease runs such a rapid course that very few symptoms may be noticed at all. When present they are in the main similar to the symptoms noticed in cattle. The muscle lesions are not so large, and do not crepitate so much.

Diagnosis.

In cases where death is sudden anthrax must be excluded, as the post-mortem appearance of the carcass in both diseases is very similar, i.e. the carcass may be very blown and a blood-tinged fluid oozes from the natural openings of the body. The local lesions are, however, typical of blackquarter, especially

when the age of the animal is also considered. The disease may be confused with snake-bite, but the discovery of the organism in muscle smears is quite conclusive.

POST-MORTEM LESIONS.

All organs are severely congested, and there may be blood-stained fluid in the heart sac, pleural and abdominal cavities, but the typical lesions are found in one of the large muscle masses, especially of the neck, shoulders, back, quarters, thighs and legs. It is seldom that more than one place is affected at the same time. Examination of these lesions shows marked blackening of the muscle which appears dryish and full of little cavities like a sponge. There is a characteristic butyric odour, and in the fibrous tissue between the muscles and under the skin there is a certain amount of blood-stained œdematous fluid.

TREATMENT.

There is no remedial treatment. The carcass should be burnt, and the same precautions put into force as described under " Anthrax." Remove all animals from the contaminated grazing and inoculate all young stock annually.

WARNING.

Blackquarter cannot be diagnosed from blood or spleen smears, and it is advised that smears be made deep from the muscle lesion. In case of doubt, a piece of muscle should be excised, cut into thin strips, and dried until it assumes the form of biltong. Muscle in this form is very convenient for dispatch to the Laboratory, where further biological investigations can be made to determine the organism responsible for the condition.

OTHER ANÆROBIC CONDITIONS SIMILAR TO BLACKQUARTER.

Hitherto in this Colony every case which has died and shown on post-mortem blood-stained subcutaneous œdema and blackening of some muscle mass with gas formation has been diagnosed as blackquarter. It is well known in other parts of the world that there are at least three other organisms which are capable of causing deaths in cattle with all the symptoms of blackquarter. The commonest of these organisms is the " vibrion septique," which causes the disease known in Europe as " malignant œdema." In South Africa and in the South-West Protectorate, malignant œdema has already been

recognised, and an efficacious vaccine has been prepared to combat it. In East Africa this disease has not yet been definitely proved, but there is little doubt that it is present.

Since the new liquid blackquarter vaccine has been issued to farmers in this country, many so-called breakdowns to blackquarter have been reported.

As the potency of this vaccine is always tested prior to issue, and a weak vaccine never sent out from the Laboratory, it would appear as if these so-called breakdowns are due to some other pathogenic anærobic organism, e.g. vibrion septique, *B. œdematiens*, etc. Immunisation against blackleg does not protect against infection by any other anærobe, so that if malignant œdema is every accurately diagnosed then a special specific vaccine will have to be made and issued for use on farms where it has been diagnosed.

To investigate whether or not blackleg is the only disease in this country caused by anærobes, farmers and others are advised to send to the laboratory material from cases of blackleg and more especially from animals that die soon after being inoculated with the liquid blackquarter vaccine. All that is necessary is to cut pieces of affected muscle into thin strips, dry in the sun (care being taken to keep away flies, etc.), and send to the Laboratory in a tightly fitting tin or bottle. No fluid or preservative of any kind must be added. It is practically impossible to tell from muscle smears whether any given case is due to malignant œdema or blackquarter, as the two organisms are so similar in their morphology.

INSTRUCTIONS FOR USE OF BLACKQUARTER LIQUID VACCINE.

Dose.—As stated on the bottle.

1. The vaccine should be used as soon as possible after it is received, and on no account should it be used later than the date specified on the label.

2. The price is 20 cents of a shilling per dose.

3. *Instruments Necessary for the Operation.*—A hypodermic syringe of 5 c.c. or 10 c.c. capacity, and about five hypodermic needles to fit the nozzle of the syringe. Where the larger capacity syringe is used, it should be graduated and fitted with a revolving wheel on the piston-rod to regulate the size of the dose.

As the vaccine cannot be drawn readily into the syringe from the opened bottle, it is convenient to include here a cup or wineglass, into which the vaccine is first poured.

It is, however, preferable not to uncork the bottle, but to fill the syringe straight from the bottle. This can be done by pushing a needle through the cork and leaving it in position until the bottle is empty. By attaching the syringe to this needle and inverting the bottle, the vaccine can easily be drawn off.

4. *Sterilization of Instruments.*—Complete sterilization of the syringe, needles and cup or wineglass before use is of the utmost importance. This is effected by boiling these for at least fifteen minutes in clean water. Prior to sterilization, the needles should first be cleaned by passing through them one of the small pieces of wire provided for the purpose. Test the syringe before use by sucking up some of the boiled water and ejecting it.

5. *Operation.*—Cattle are best vaccinated on the side of the neck, just in front of the shoulder; here clip the hair off a patch of skin about the size of the hand, and wash the part thoroughly with $2\frac{1}{2}$ per cent carbolic acid (a tablespoon to a pint of water), or some other disinfectant. Take up a fold, and insert the needle and syringe together, pressing with the finger on the skin over the needle, to prevent the vaccine escaping again.

6. *Reaction after Vaccination.*—The vaccine is absolutely germ-free, and does not contain any markedly toxic substances. As is to be expected therefore, practically no reaction is set up in the animal.

There may be a mild fever reaction for the first few days after vaccination, but this will hardly be noticeable.

7. *Age at which Cattle are Susceptible to Blackquarter and Require to be Vaccinated.*—From the age of six months to three years, cattle are susceptible to blackquarter, but outside these limits cases occur, especially on heavily infected farms. Usually therefore animals should be vaccinated for the first time at six to nine months, but in the exceptional cases above mentioned it would be advisable to carry out the first inoculation at about three months.

8. *Immunity Conferred.*—As complete immunity is not established for about two weeks after inoculation, and the incubation period of the disease may vary up to seven days, it

must not be expected that the mortality will always stop immediately after inoculation. The protection afforded by the vaccine is expected to last about nine to twelve months but, as is the case with all makes of blackquarter vaccines, the immunity must be considered to become gradually weaker after the sixth month. For this reason it may be advisable to re-inoculate young stock during the most susceptible period, i.e. between the ages of nine and eighteen months, after an interval of six months; this extra precautionary measure is recommended especially on badly-infected farms and particularly in the case of valuable cattle.

9. After using the vaccine, instruments should be thoroughly sterilized in clean water before putting them away; also any vaccine left over in an opened bottle should be thrown away, as the vaccine will not keep once the bottle has been opened.

10. Every care is taken in the preparation of the vaccine, but no guarantee regarding its safety or efficacy is given.

11. In case of any complaints, the Chief Veterinary Research Officer will be pleased if all details are communicated to him immediately.

FOOT-AND-MOUTH DISEASE.

This is an acute febrile infectious disease, in the course of which a vesicular eruption develops, particularly in the mouth and in between the claws and on other parts of the foot; hence the name "foot-and-mouth disease." The lesions may also occur on the skin, particularly of the teats in females.

The mortality from foot-and-mouth disease in this country is not serious, but from an economical point of view the disease is of importance, particularly if it occurs in dairy herds, owing to the loss in milk production; in beef herds there is usually loss of condition, especially if an outbreak occurs when there is a scarcity of grazing and water necessitating affected animals travelling some distance.

ANIMALS AFFECTED.

Animals other than bovines which are susceptible are domestic ruminants and some species of game. Pigs also suffer. The disease rarely attacks the horse, the dog and the domestic fowl. Human beings, especially children, may contract the disease through the milk of affected animals.

SUSCEPTIBILITY.

Cattle are most susceptible to natural infection; then swine, sheep and goats.

CAUSE.

The virus of foot-and-mouth disease is ultra-microscopic and is contained in the contents of the vesicles and in the blood at the beginning of the temperature reaction; the saliva and nasal discharge are infective if contaminated with the contents of the vesicles; the milk, according to some investigators, may be infectious at the beginning of the temperature reaction.

MODE OF INFECTION.

Infection may be transmitted direct from sick to healthy cattle if in close contact, but indirect transmission is usually responsible. The infected mouth and nasal secretions can infect the water, grazing, buildings in which affected animals are housed, stockyards, hands and clothing of attendants, etc.

Infection can be carried in the feed, litter, hides, wool, milk, carcasses of affected animals, and by-products.

The virus can exist for a long time in the hoof and horn lesions.

Injuries of the mucous membranes of the mouth, of the skin, favour the entrance of the virus and setting up of infection.

Infection in young animals suckling on infected mothers or being fed with infected milk can occur through the mucous membrane of the digestive tract.

INCUBATION PERIOD.

After natural infection, the incubation period varies from two to seven days, exceptionally longer; after intravenous injection of the virus in cattle, it varies from a few hours to six days; after inoculation into the mucous membranes of the mouth, forty-eight to sixty hours.

SYMPTOMS.

The disease commences with a rising temperature, which is usually more evident in young than old animals; in the first day or two it may react as high as 105° F., but when the vesicles develop it drops and the latter course of the disease runs without fever. Animals with mouth lesions chew their food slowly and salivate profusely. The eruption in the

mouth appears as small blisters containing a watery-like fluid which later becomes cloudy. These soon rupture, leaving isolated raw sores which vary in size up to a shilling or larger; they usually occur under the tip, on the sides and top of the tongue, on the inner surface of the cheeks, inner surface of the lips and on the gums. After two to three days the sores are covered by proliferating epithelium and for a time yellowish-brown spots remain. In many cases simultaneously with the mouth lesions similar vesicles appear on the feet at various sites, viz. between the claws, around the top of the hoof, and on the heels. One or all feet may become affected, vesicles may appear between the horny and sensitive foot and separation of the horn from the foot occurs. The lameness disappears after some weeks or it may persist for a long time, depending on the injury to the foot. The udder sometimes becomes involved. Lesions may occur rarely on the nasal mucous membrane, pharynx, windpipe and air passages of the lungs. Young sucking calves have been known to die suddenly of foot-and-mouth disease without showing any typical symptoms.

When the feet are involved, lameness or a stiff gait is usually evident, and if more than one foot or if all four feet are affected the animals are usually found lying.

When the skin of the udder is affected, vesicles develop as a rule on the teats and there may be a catarrh of the milk ducts, in which case the milk is yellowish-white in colour and coagulates easily. In exceptional cases it contains flakes of mucus which tend to block the milk ducts.

Complications may occur which aggravate the course of the disease; e.g., when the inflammatory process spreads to the lungs a broncho-pneumonia occurs, the lesions on the tongue and in the mouth may develop into ulcers as a result of a secondary infection.

Suppurating ulcers occur more often on the feet and may lead to the formation of abscesses, and the infective material burrows between the hoof and the sensitive foot, ending in the loss of the hoof and possibly necrosis of the bones of the foot. The affection of the udder may lead to deep abscesses in the affected quarter. Septicæmia and pyæmia sometimes occur as a sequel, ending fatally, and in some instances abortion occurs as a complication of the disease.

POST-MORTEM LESIONS.

The mouth and feet may show all or only some of the changes described above. Other pathological changes are sometimes present but they are so various that they cannot be considered as characteristic. Inflammation and ulceration of the stomach and intestines is sometimes present; the spleen may be moderately swollen and there may be hæmorrhages on the serous membranes and pericardium; purulent inflammation of the joints and abscesses in different parts of the body occur in cases complicated with suppurating lesions. Pneumonia, due to the inhalation of saliva or food, is sometimes present.

DIFFERENTIAL DIAGNOSIS.

In this Colony, the mouth lesions may be confused with rinderpest, but the erosions on the gums in the latter disease are irregularly formed and the necrotic epithelium in their vicinity may be readily removed by wiping; in foot-and-mouth disease the lesions are more or less round and are surrounded by white vesicular threads or by a white epithelial zone; in rinderpest there is usually diarrhœa and the disease runs a more virulent course.

In the peracute cases which occur in calves, where no distinctive lesions are apparent, the existence of foot-and-mouth disease in the mother or in the herd should enter into consideration.

Lameness, when it occurs from an injury or wound in the foot, can usually be differentiated from the foot-and-mouth foot lameness. It is unusual to find lameness due to injuries in a number of animals in the herd; on the contrary, it is usual to find a number of lame animals when foot-and-mouth disease occurs.

TREATMENT.

Since there is no specific curative agent yet available, treatment should be directed towards allaying the local inflammatory process, viz. application of antiseptics or astringents.

PREVENTION.

In general this follows the lines applicable to other infectious diseases, viz. that healthy animals should be prevented in every possible way from coming in contact with affected animals or with those which have recovered within a short time, and that any possible transmission of the virus from sick to healthy animals by intermediate means should be guarded against. Calves should not be allowed to suck the milk of infected mothers.

In some countries emergency inoculation and immunisation is resorted to. The purpose of emergency inoculation is to shorten the course of the disease and is only employed in infected herds. It consists of the artificial infection of all animals in the herd when the disease first appears by rubbing the mucous membrane of the mouth with virus from the vesicles or by blood or serum of a convalescent beast and simultaneously rubbing the buccal mucous membrane with infectious saliva.

IMMUNISATION.

A passive immunity, lasting for a period of a few weeks, is said to be conferred by inoculating blood serum from recovered animals.

Active immunisation consists of the simultaneous injection of virus and serum. The results obtained have not been satisfactory.

Recovery from the disease naturally contracted reduces the susceptibility for a varying period.

Calves from cows which recovered from the disease during pregnancy are sometimes immune.

CONTAGIOUS ABORTION.

This disease occurs in all the commoner farm animals and is specific for each type of animal. Bovine, equine and probably porcine infectious abortions occur in this Colony. The bovine variety is very prevalent both in the settled areas and amongst native cattle and is undoubtedly one of the most insidious diseases in the Colony.

BOVINE INFECTIOUS ABORTION.

Cause.—The responsible organism is a very minute bacillus which exists in enormous numbers in the vaginal excretions and uterus of an animal which has recently aborted, in the expelled foetus, and in the foetal envelopes. The pregnant uterus is the favourite habitat of the organism but when the animal is not pregnant and the uterus quiescent the organism retires to the udder and its associated lymphatic gland. It will thus be understood that the various discharges from an animal recently aborted are heavily charged with the specific organism and it is by the ingestion of pasture, food or water infected by such discharges that a healthy cow is infected with the disease. It is reckoned that, after involution of the uterus, the organisms are no longer discharged via the sexual tracts. This vaginal discharge should cease within six weeks to three

months after abortion, but the danger now is that the organism is situated in the udder and its glands and only waiting for a further pregnancy before it returns to its favourite habitat. Infection is generally carried to a healthy animal by the contamination of food and water; it is exceedingly rare via the sexual tract and the bull may be virtually excluded as a carrier of the disease. Undoubtedly under certain conditions the bull may transmit infection, *either* mechanically as when he serves a clean cow after covering one with a vaginal discharge containing the organism *or* by ejaculating into the vagina of a healthy cow the organism in his semen as the result of diseased condition of his genitalia.

It has been recognised recently that the flicking of vaginal discharge by the tail may also spread the disease as it is only necessary for a small amount of virulent material to alight on the eye-ball of an adjacent clean cow to infect her. When the organism is located in the udder the milk is infective. Such milk if carelessly spilt over the premises will help to spread infection but there is no harm in letting calves have milk from an infected cow as long as *they have not reached* the breeding age.

Symptoms are those of parturition, except when the abortion occurs very early in gestation when no symptoms may be seen at all. Under these circumstances the abortion may occur while the animal is at grass and no one be any the wiser until the cow comes back into " heat " in twenty-one days, or unless there is a noticeable vaginal discharge, or there are symptoms of retained membranes.

Abortions generally occur in the fifth or sixth months but they may occur before or after these times. An animal may abort more than once but this is the exception and not the rule. In a few cases a cow, infected with the causal organism and positive to the agglutination test, may never abort at all. These animals are known as " carriers " and are obviously very undesirable members in a herd for they maintain infection and may never be suspected until their blood is subjected to the serum test.

Diagnosis is very easily made because several abortions occur practically simultaneously. In all cases of doubt a positive diagnosis can be obtained if blood samples are sent to the laboratory for the serum diagnosis test. Sporadic cases of abortion occur as a sequel to several extraneous causes, e.g. some accident, dipping, result of being chased by dogs or other vermin, poisonous plants, various infectious diseases, etc.

Post-mortem appearances of aborted material present very regular features, e.g. œdema and congestion of the fœtal envelopes and a muco-purulent exudate between the cotyledons (i.e. those rounded fleshy bodies which attach the fœtus and its envelopes to the wall of the womb). Fœtuses aborted early in pregnancy are usually dead and those expelled at a later date seldom live very long, while those born near " full time," if they live, are weak and highly susceptible to every disease to which young calves are subject. Joint lesions are especially common in prematurely born calves.

Treatment.—There is no medicinal treatment. Prevention should be aimed at as this disease leads to enormous economic loss as result of loss of milk and loss of calf. For further and fuller information on the control of this disease the stockowner is advised to procure the brochure entitled " The Prevention and Control of Contagious Abortion " from this Laboratory.

A vaccine is issued for inoculation of cattle in heavily infected herds and is used on animals some two months or so before being put to the bull. The immunity conferred by the vaccine protects the cows through the normal gestation period.

Directions for the use of Contagious Abortion Vaccine.— Vaccination aims at reducing the losses in an infected herd by inducing in the inoculated animals a degree of resistance to the disease sufficient to enable them to carry their calves to full term and so establish a high degree of resistance in the herd in a much shorter time than that required for the natural process to operate.

In addition to vaccination, disinfection of infected animals and premises should be carried out to obviate the resistance of the animals being strained by gross infection.

Before deciding on the adoption of vaccination as means of controlling the disease, an owner is advised to consult his veterinary officer.

In a herd in which the degree of infection is small and provided the premises are suitable, it may advisable to consider whether the method of control by rigid isolation and disinfection would not be more advantageous than vaccination.

Vaccination should not be adopted in non-infected herds.

The vaccine is a living culture of the causal bacillus.

It must be used on non-pregnant animals only.

An animal must not be served until two months after vaccination.

Full-time calvers may be vaccinated as soon as they have cleansed and recovered from calving.

Vaccination must only be carried out on animals in good health.

If vaccination is carefully carried out, as a rule nothing more than a small temporary swelling at the seat of inoculation is to be seen; in milking animals there is frequently a temporary reduction in the milk yield. Only a few animals show a considerable constitutional disturbance after inoculation.

This vaccine is supplied without any guarantee whatsoever.

Technique of Inoculation.

1. The dose is 5 c.c. inoculated subcutaneously, behind the shoulder or on the side of the neck.

2. The vaccine must not be stored longer than a few days after receipt and should be kept in the cool and protected from sunlight.

3. The operation must be conducted with strict antiseptic precautions; the syringe, needles and utensils should be sterilized by boiling in the first instance, but it will be sufficient during the progress of the operations on the same establishment to rinse the needles and utensils periodically in boiling water. Care must be taken not to bring the vaccine in contact with hot syringes or other utensils, as the abortion bacillus might be killed by doing so.

4. After the bottles which contain the vaccine have been emptied they should be dropped into strong disinfectant together with their corks.

Contagious Abortion in Mares.

This condition has been diagnosed in a few studs in this Colony and is probably more prevalent than formerly supposed. It is a very serious condition and may result in a heavy foal mortality or if the latter are born alive, in the production of weedy animals suffering from ungainly, troublesome and often incurable joint lesions.

Cause is a small organism belonging to the paratyphoid group. In some outbreaks, however, a short-chained streptococcus has been inculpated. Infection of the dam occurs as a result of ingestion of contaminated food and water, and the

infection reaches the fœtus via the placental circulation. The disease is essentially a specific inflammation of the womb and the abortion of the foal follows as result of the pathological changes in the womb of the mare.

Symptoms are those of abortion, which may occur very early in pregnancy or during the eighth month or so. Foals aborted after a gestation period of ten and a half months survive but they generally die in a short time either from pneumonia or from a fatal white diarrhœa, while animals aborted early in pregnancy are practically always dead at the time of expulsion. As regards the dam, recovery from the abortion is the rule but odd cases succumb to sepsis of the womb. After abortion there may be a more or less pronounced vaginal discharge of a characteristic chocolate brown colour and having a peculiar characteristic " sour " odour.

Diagnosis may be made from the history of the case, the colour and nature of the vaginal discharge, the more or less simultaneous abortions of several mares in the same stud and by the serum diagnosis test.

Treatment.—Isolate all pregnant mares, destroy by fire all aborted material and discharges, all soiled litter, fodder and utensils. Change of food and water supply should be made whenever possible. It must be remembered that this disease in the mare is very different in its pathology from bovine contagious abortion. In the mare the disease is essentially a constitutional one of the dam, the death of the fœtus and its premature expulsion being entirely secondary.

Some success has followed the use of a vaccine but as it is only experimental no definite information can be given on its efficacy. Good results, however, have been claimed for it in the United States.

Contagious abortion in the mare tends to die down naturally and does not exist enzootically on a farm as does the same disease in cattle. Very often attention to the hygiene of the stud and a change of food and water are all that are needed to combat the disease.

Contagious Abortion in Swine.

This condition has never been actually diagnosed in Kenya but an outbreak of abortion amongst swine was reported from the Molo district, but as no detailed bacteriological investigation was carried out it is not possible to say whether the outbreak was due to specific cause or only accidental.

Swine abortion is a well-known disease in such well-known pig breeding countries as Germany and the United States. It is due to one of two organisms both of which have a wide distribution.

The symptoms, pathology, treatment and prevention of this disease is very similar to what has already been described under bovine contagious abortion.

Stockowners are advised to be on the qui vive for this disease and to send to the laboratory for examination aborted swine fœtuses *without* the addition of any preservative.

Contagious Abortion in Ewes.

This condition has not yet been diagnosed in this Colony, but as it occurs in Europe and other parts of the world its incidence here may only be a matter of time. Sheep farmers are, therefore, advised to be on their guard for the appearance of this disease in their flocks and on the slightest suspicion that it exists, should communicate with the Laboratory without delay.

CONTAGIOUS GRANULAR (NODULAR) VAGINITIS.

This is another disease which has never been accurately diagnosed in this Colony but whose presence has been suspected by many competent authorities.

This disease is very contagious and is spread by copulation or by other means which might introduce infection into a healthy vagina. It may complicate contagious abortion, but it may exist independently of that disease. Although it runs a mild course it may cause temporary sterility and frequent returning to the bull, though as a cause of sterility its role has been greatly over-estimated. When the disease is rampant in a herd and many cows are sterile other factors are responsible, e.g. contagious abortion, functional sterility or pathological lesions in the ovaries and sexual canal.

Cause is a minute organism present in enormous numbers in the vaginal discharge which is thus very infectious.

Symptoms.—There may be few or no constitutional disturbances. There may be slight glairy vaginal discharge, which later tends to become muco-purulent. Frequent urination, straining, erection of the clitoris and contant returning to the bull are common symptoms which are very similar to what are found in nymphomaniacs.

Examination of the vulva and vagina shows intense congestion and the appearance of small nodules or granules under the pink membrane. These nodules are arranged in longitudinal series or ridges and are most numerous on the floor of the passages. They increase in size and finally rupture, causing the muco-purulent discharge already described.

Treatment is only indicated when the animal is not pregnant or in the absence of sterility. The vagina and vulva should be carefully washed out with a mild astringent antiseptic such as equal parts of sulphate of zinc and acetate of lead (6—8 grains) in one ounce of clean boiled water. Iodoform pessaries are also very useful.

In the bull mild symptoms are also noticed. The penis may be very red in colour and covered with small granules or nodules. Treatment is by washing out the sheath and the penis with the lotion described above. Animals showing acute symptoms of this disease should not be bred from until they have quite recovered. The disease is a very mild one and readily yields to treatment. Affected animals should, of course, be isolated and every attention should be paid to the hygiene of the cattle byres in order to arrest the spread of the disease.

COITAL EXANTHEMA (VESICULAR EXANTHEMA OF THE GENITALS).

This disease occurs in cattle, horses and sheep. It is transmitted during coitus and is characterised by vesicular and pustular lesions of the external genitals. It attacks both sexes. Undoubtedly this condition occurs in this Colony and appears to be quite common in sheep, especially rams.

Cause is not known, but the virus is present in the lesions and discharges.

Lesions in the Male.—The penis is covered with vesicles which soon turn into pustules, while the sheath is similarly affected. There is a variable amount of muco-purulent discharge from the urethra and local symptoms of uneasiness, frequent and painful micturation, etc., may be very pronounced.

Lesions in the Female.—The vagina and the lips of the vulva are swollen and red while there is a glairy discharge from the entire passage. Vesicles form and are followed by pustules which rupture and form angry-looking ulcers. There is frequently straining, erection of the clitoris, etc., which gives the animal the appearance of being in constant " heat ".

Constitutional Symptoms in Both Sexes.—There may be none at all or else they may be present to a moderate degree. There may be one or two degrees of fever, cessation of rumination and a slight diarrhœa or, in some cases, constipation.

The animal may fall off considerably in condition.

Remarks.—This condition is known as '' bull burn '' or balanitis when it affects the male. It is not clear if the same disease affects horses, cattle and sheep or if each species of animal has its own specific infection. Recovery from one attack confers no immunity.

Treatment.—Isolate affected animals and place on a light laxative diet. A mild purgative should be administered while to the genital lesions a mild astringent antiseptic should be applied, e.g. sulphate of zinc and acetate of lead (4—6 grains of each) in one ounce of sterile water. When the disease has been recognised on a farm the genitals of the bull should be washed after each service.

STERILITY.

Only a very brief survey of this subject can be given in this publication.

Sterility, unfruitfulness, or barrenness, means the failure on the part of an animal, male or female, to procreate its species. (A. Wilson.) It is a disease, or rather a symptom of disease, of the essential reproductive organs.

CAUSES.

Many factors which limit or prevent fertility are probably merely predisposing causes, while the actual cause is often a definite diseased state of some part or parts of the genital organs. The condition is much more common in the female than in the male and the explanation of this is easy, for the female genitalia are exposed to enormous risks at parturition, while, of course, contagious abortion is essentially a disease of the cow. It is reckoned that eighty per cent of sterility in cows is due to infection by contagious abortion. By many authorities contagious abortion and sterility are described as different phases of the one infection. The most serious result of abortion is partial or complete retention of the after-birth (placenta). This occurs especially if the abortion occurs late in pregnancy but even after a normal parturition, if the after-birth is not removed, it leads to grave inflammatory changes in the uterus. After an abortion the uterus and

vaginal passage teem with bacteria which find an ideal nidus for further proliferation in a decomposed retained after-birth. The result of this chain of events is a chronic inflammation of the uterus which by destroying the normal lining membrane of the womb renders further pregnancies impossible. As result of these grave uterine lesions or of an abortion, abnormal changes occur in the ovaries which culminate in the formation of cysts or of the formation of retained yellow bodies (*corpora lutea*). Uterine and ovarian lesions may occur simultaneously in the same animal but very often they occur independently of one another and in many cases it is very difficult to say whether the ovarian or the uterine lesion is primary or secondary. In any case the formation of ovarian cysts or of persistent yellow bodies is indicative of grave pathological changes and a serious interference with the normal hormonic activity of the female gonads. As long as yellow bodies persist in an ovary no ova will be formed and the cow will not come " into season."

Other causes of sterility are (1) physical inability to copulate, which occurs most often in males, especially stallions ; (2) malformations, abnormalities of the sexual apparatus which are comparatively rare and only found in a few animals from time to time ; (3) age ; (4) excessive sexual use, which occurs mainly in the sire, especially young bulls first put to stud when their semen becomes thin and the sperms few and sluggish ; (5) in-breeding is responsible for a few cases of sterility by reducing the vigour and the fertility ; (6) climatic and nervous influences. Spring is the natural time for conception and animals are often successfully covered at this time after appearing to be sterile when mated at other seasons. Nervous influences are generally seen in highly bred mares which possess a remarkably sensitive vagina in a continual state of spasm and, therefore, unable to retain the semen of the stallion. This sensitiveness appears to be temperamental and may be overcome by judicously working or galloping the mare prior to service. Ejection of semen may be prevented by dashing cold water over the loins after service or by exercising the animal so as to distract her attention. The use of sedatives before copulation or artificial insemination may have to be resorted to in extreme cases, but the former is a most undesirable procedure.

Another cause of sterility (generally temporary) is lack of exercise. All animals of both sexes should be regularly worked in order to maintain their breeding powers. It is a well-known

fact that animals in show condition are very prone to be sterile and obesity is regarded by many breeders as a troublesome cause of sterility. It is now agreed that many foods lacking in Vitamin E do not conduce to fertility. Highly nitrogenous foods, e.g. peas and beans increase sexual desire while grains, maize, etc., have the opposite effect. It is obvious that sires called upon to serve a large number of females require a generous diet rich in proteids but as mentioned before over-feeding and lack of exercise must be avoided. It must be remembered, however, that in some cases obesity is the result of sterility and not its cause. Ovarian lesions in particular are very often accompanied by great obesity.

Symptoms of Sterility.

It is important to remember that the regular appearance of œstrum (heat) is no criterion of the female's ability to breed any more than the desire or ability to copulate is proof of a male's potency. Undoubtedly the most important symptom in the female is the occurrence of abnormal œstrum, i.e. whether it is absent altogether, excessive in amount, too frequent in occurrence, too weak or too short. The healthy cow should come " into use " every twenty to twenty-two days—with an average of twenty-one days—and the " flow " should last for a period varying from sixteen to twenty hours. After calving, the cow should be ready for the bull in twenty-one to twenty-eight days, but this period may be delayed in deep milkers.

Excessive heat occurs in the condition known as nymphomania in which there is practically constant sexual excitement. This condition is well-known in mares, which become ticklish, vicious, squeal on being touched and are continually raising the clitoris and passing small quantities of urine. Similar symptoms appear in nymphomaniac cows which are known as " bullers ". This disease is due to ovarian cysts and to chronic inflammation of cervix and uterus. Treatment of this affection is generally hopeless.

Oestrum may be too brief or too protracted. Weak œstrum occurs in dairy cattle and is often unaccompanied by any disease at all. It is said to be relieved by regular exercise.

In other cases œstrum may be absent altogether. Such animals are popularly known as " dumb bullers " and they suffer from advanced ovarian and uterine diseases.

Although the symptoms described above are not always associated with sterility they are fairly constant and it behoves every stockowner and dairyman who is interested in sterility to keep careful records of the nature, character and period of the œstrum of his cattle.

Besides the points noted above local symptoms may be found, e.g. relaxation of the pelvic ligaments leading to a sunken appearance of the quarters and a grossly exaggerated raised condition of the root of the tail. This abnormal feature is due to ovarian disease and is generally accompanied by relaxation of the vagina and a slight slimy discharge.

Other local symptoms also occur but are so difficult to detect as to ascape notice except by an expert.

Diagnosis.

In order to assist stockowners in arriving at a diagnosis of sterility the following classification of Zschokke is appended and may prove of benefit, viz :—

(1) *When heat is absent*—due to

    (a) general causes—feeding, heavy lactation, general diseases, etc. ;

    (b) special cases—freemartins, in-breeding, persistent yellow bodies, tuberculosis, etc.

(2) *When heat is feeble*—due to heavy milking, malnutrition, disease, keeping in confinement.

(3) *When heat occurs but conception does not follow*—due to

    (a) when heat is regular—mechanical hindrances, full-blooded animals straining after service, acidity of vagina, uterine diseases, etc. ;

    (b) when heat is too frequent—ovarian diseases and cysts, nymphomania.

(4) *When animal becomes pregnant, but the fœtus dies*— due to abortion and other infections, bad feeding, abnormal development of fœtus, etc.

It will be seen from Zschokke's classification that great emphasis is laid on the physiological character of œstrum and it is absolutely necessary that stockowners should keep careful records of the œstral histories of their cattle before any detailed investigation can be carried out into the cause of sterility in their herds.

Treatment of Sterility.

This is a colossal subject, as it entails a very thorough knowledge of the anatomy of the female sexual organs. Obviously it cannot be discussed in an article of this nature and every farmer is advised to seek professional advice before trying to treat sterility in his herd. This is especially the case if treatment entails direct manipulation of the ovaries or uterus. Where treatment is simple and consists in the correction of mistakes committed in the general management or hygiene of the animals the farmer should be quite able to manage by himself but it is obvious a correct diagnosis of the cause of sterility must first be made. If the farmer or stockowner in this Colony eradicates contagious abortion from his herd and pays strict and personal attention to the hygience of his cows at the time of parturition, he will find that sterility is a condition which will not trouble him very much. It is too often the fact that cows calving in this country are grossly mishandled by ignorant and dirty native herdsmen who, because of their lack of knowledge of cleanliness, are responsible for numerous cases of metritis as result of rough usage during delivery of the calf and by introduction of their dirty hands, knives, etc. into vagina.

Morbid conditions of the ovaries and uterus leading to sterility are most difficult to treat successfully and their treatment should only be carried out under professional advice.

Addendum.

The following table of œstrum may prove of some assistance for stockowners in the recognition of the proper times, intervals, etc. at which the various animals should be ready for stud purposes, viz :—

Species of Animal.	Duration of Oestrum.	Return after Parturition.	Return if not Impregnated.
Mare	5-7 days	7-10 days	2-3 weeks or more
Cow	1-3 days	21-23 days	3-4 weeks or more
Ewe	1-2 days	4-6 months	17-20 days
Sow	2-4 days	5-6 weeks	20-21 days
Bitch	1-3 weeks	5-6 weeks	5-6 months

COLON BACILLOSIS (WHITE SCOURS OF SUCKLINGS).

This is an acute contagious disease of newly born calves, characterised by marked diarrhœa. Various organisms may be responsible for calf scours, e.g. aerogenes bacillus, para. coli, pyocyaneus bacillus, proteus bacillus, abortion bacillus, etc., but in most cases the organism responsible is a virulent type of bacillus coli.

OCCURRENCE.

In addition to newly born calves, colon bacillosis sometimes occurs in foals, lambs and pigs.

PATHOGENICITY.

The colon bacillus is a constant harmless inhabitant of the intestinal tract of animals and man but under certain predisposing conditions, viz. digestive disturbances and lowered vitality brought on by faulty feeding and management it becomes pathogenic. Withholding the colostral milk from the calf and the feeding of boiled milk immediately after birth are also factors. Boiling the milk is said to destroy substances (ferments) which counteract the development of diarrhœa by stimulating the functions of the digestive glands thus preventing the excessive multiplicaton of the normal intestinal bacteria.

Errors in dieting also predispose to the multiplication of normal intestinal bacteria and development of the disease. Changes occur in the bowel wall as the result of the digestive disturbances. The bacteria penetrate into the intestinal wall and invade the blood and organs and produce a bacteremia.

Under the above-mentioned conditions the virulence becomes exalted and the disease is likely to occur in an epizootic form amongst the calves.

NATURAL INFECTION.

When colon bacillosis occurs in localities hitherto free of the disease, or at long intervals, the inference is that the ordinary harmless colon bacilli have become exalted in virulence. The bacillus may occur in the vagina of the mother, it can also live in the ground, the floor and litter of calf-pens, and bomas, from which the udder of the mother becomes contaminated.

The baccillus gains entrance by either of two routes.

(1) The common route is held to be by the mouth during the ingestion of contaminated material; infection also occurs when the calf sucks the contaminated udder;

licking the walls of infected calf-pens or sheds is another source of infection. Infection may also occur in artificially-fed calves through the mouth by the contaminated hands of attendants, the use of infected drinking vessels, etc.

(2) Another route is through the umbilicus immediately after birth.

The possibility of an intra-uterine affection has been proved by some investigators.

INCUBATION PERIOD.

Calves become affected usually twenty-four to twenty-eight hours, rarely from three to eight days, after birth.

SYMPTOMS.

The symptoms of the disease are particularly diverse but the following have been especially noted as occurring in this Colony :—

(1) Death within the first three or four days after birth, the only symptoms being dullness, inappetence and occasionally dysentery.

(2) Dysentery or " scour " in calves from one day to about two weeks old. The colour of the discharge may vary from white to almost black.

(3) Pneumonia in calves of two to four weeks or over usually accompanied by diarrhœa.

(4) Unthriftiness in well-fed calves of one or two months old. This may be the sequel of an earlier infection which has passed unnoticed or it may be an immediate result of a more chronic type of the infection. Sometimes this form is accompanied by a sub-acute or chronic diarrhœa and should be dis-associated from indigestion arising from faulty feeding or mismanagement. In types 1 and 2 and sometimes 3, an elevated temperature is often registered.

POST-MORTEM LESIONS.

These vary according to the type of the disease met with, e.g. in type No. 1 a slight inflammation of the intestines may be the only change observed; while in type No. 2 there is usually a well marked inflammation of the small intestines and a congestion of the abdominal organs patricularly noticeable in the liver which may be very swollen. The small intestines

contain a putrid yellowish fluid mixed with mucus. The mucous membrane is covered with mucus and shows hæmorrhages. The lymph follicles and Peyers patches are swollen. The mesenteric glands are enlarged and œdematous. The mucous membranes of the large intestines show similar changes but not so marked.

In type No. 3 one or both lungs show the worst changes. Pneumonia in different stages may exist; sometimes there are many purulent centres in the consolidated lung; or darkened and hardened portions of one or both lungs may only exist. In this type too there may be found signs of an old intestinal inflammation, while in type No. 4 an emaciated carcass with anæmia and slight changes in the bowels are often the only lessions observed.

DIAGNOSIS.

As stated above, various organisms may be responsible for calf scours and to accurately determine which is responsible, a bacteriological examination of organs. intestines and the blood is necessary.

TREATMENT.

Usually a mildly acting purgative to rid the bowels of the fermenting contents is given, e.g. castor oil. When purgation commences gruels should be administered. They may be given with or without opium, to which some chalk or magnesia may be added. Intestinal disinfectants such as salicylic acid may be given together with tannin; tanniform, naphthalene, salol has been used beneficially. Animal charcoal has been highly recommended.

Injections of saline into the rectum (two litres) repeated if necessary in two to four hours have often given good results.

PREVENTION.

Prevention is recommended on the two following lines both of which should be practised together if the disease has already broken out on the farm.

(1) Calving the cows down on clean bomas where the disease is known not to have previously existed and immediately the calf is born to disinfect the navel with a solution of one of the proprietary disinfectants. Subsequently to tie the navel cord with a cotton string or a piece of tape about two inches from the abdomen and then to paint the whole of the umbilical region with iodine solution.

(2) Vaccination of the calf immediately it is born, or as soon as possible after birth.

Calves in good condition run a better chance of withstanding this and other diseases than those which are in poor condition.

It is a common practice with some stockbreeders to endeavour to dairy and ranch at the same time; this cannot be too severely deprecated. A young grade calf born to a native cow requires all its mother's milk to sustain it in a normal state of vitality, and when it is considered that a number of such calves are deprived of quite half of their quota of food as the result of milking it is not extraordinary to find such impoverished calves the victims of disease.

In calves reared under ranching conditions it is unusual to find the occurrence of white scours. On the contrary, in dairy-reared calves on some estates the disease is fairly common. Dairy-reared calves should be allowed to suck the collostral milk from immediately after birth and allowed to feed from their mothers at regular intervals, or be given a liberal allowance of whole milk at regular intervals. Attention should be given to the calf-houses which should be kept in a hygienic condition.

Preventive Immunisation.

In some countries an anti-serum is obtained by injecting horses or goats and sheep with living cultures of the colon bacillus. It is now the practice to inject the serum-makers with various strains of the colon bacillus so as to obtain a polyvalent serum. In practice the results obtained have not always been satisfactory.

BACILLARY NECROSIS.

This is another disease which in cattle as a rule only affects calves.

Cause.

The causal agent is known as the *Bacillus necrophorus* (Bang.). In the affected tissue it grows into thread-like filaments which can be detected microscopically in stained sections.

Natural Infection.

The bacillus is fairly prevalent in nature, and is frequently contained in the faeces of herbivorous animals. It has a saprophyte existence outside the body, and is capable of living in the soil and floors of stables, in food, straw, etc.,

from whence it gains access to the tissues; abrasions of the mucous membranes of the mouth and site of eruption of the milk teeth is frequently the starting point of infection. Calves become affected as early as a few days after birth. The susceptibility of the young is increased by bad hygiene and improper feeding. The disease is easily transmitted from infected to clean calves by contact.

SYMPTOMS.

The first symptom observed is a soreness of the mouth and increased salivation, due to the formation of a small yellowish point or points on the tongue or elsewhere in the mouth. These points at first are small but gradually increase in size, developing towards the later stages up to half an inch in radius. As the development proceeds in the mouth, the infection is swallowed with the food and sets up similar lesions in one or other of the stomachs. The infection sometimes invades the liver, again setting up necrotic areas; in some cases the pharynx, larynx and lungs become affected. When diarrhœa is present it points to involvement of the intestines; exceptionally there occurs swelling and suppuration of the lymph glands of the head and necrosis of the tissues of the feet between the claws or around the top of the hoof.

The appearance of a fully-developed necrotic area is that of an ulcer or ordinary open sore, deeply pitted, and containing a thick cheesy-like material.

COURSE.

In cases which terminate fatally the animal becomes emaciated and weak apparently from the absorption of toxins, and death occurs in from four or five days to three weeks. In cases which recover, convalescence lasts several weeks.

POST-MORTEM LESIONS.

Centres of infection as described above may be found in advanced cases in the mouth, pharynx, larynx, lungs, stomach, liver and elsewhere. Emaciation of the carcass and anæmia will also be noted.

TREATMENT.

In the early stages, curative treatment may be of assistance, but slaughter is usually more economical. The treatment consists of the scraping of the necrotic centres with a blunt instrument and the application of an antiseptic once or

twice daily. Various medicinal agents are recommended for local application, viz. tincture of iodine, 10 per cent citric acid, 5 per cent solution of permanganate of potash, a paste consisting of water and salicylic acid, etc.

Frequently the necrotic areas are situated far back in the mouth, and it is necessary in order to apply the treatment to use a stick.

PREVENTIVE MEASURES.

It is usual to find the disease occurring in calf bomas or buildings used for housing calves. New bomas or calf-houses should be erected on a clean site and the infected bomas sterilized by burning the litter; burning of grass is of assistance in sterilizing the bomas and floors of buildings if of earth. Infected calf-houses should be sterilized with lime-wash.

Vessels used for feeding hand-reared calves should be kept free of infection by frequent boiling.

PARATYPHOID.

The febrile affections caused by paratyphoid bacilli which manifest symptoms of a general blood infection or a gastro-intestinal inflammation are grouped under the general term paratyphoid.

Whereas the occurrence of organisms chiefly of the paratyphoid (*B. enteritidis*) group are described as occurring in calves in European countries since the latter end of the nineteenth century, and paratyphoid has been classified for some time as an independent disease, it is only during the last two or three years that serious attention has been given to the existence of paratyphoid infections in calves in this Colony.

ETIOLOGY.

The paratyphoid bacilli correspond in appearance with the bacillus coli and the human typhoid bacillus, but are distinguishable by certain cultural characteristics. The paratyphoid infections in calves in South Africa appear to be mainly caused by the *B. enteritidis* (Gaertner) group, but organisms belonging to another type (B. aertrycke) have also been isolated in some outbreaks. In Kenya Colony the organism obtained from outbreaks shows, it appears, certain differences from the ordinary B. enteritidis (Gaertner) strains usually found in South Africa and Europe.

Whilst paratyphoid infections may occur as an independent disease, there are usually certain factors involved in the production of the disease, namely :—

(1) Improper and irregular feeding and bad hygienic conditions, leading to digestive disturbances.

(2) Infection with piroplasms and anaplasms.

In some outbreaks, paratyphoid is commonly found as a complication of redwater and more often of anaplasmosis. Paratyphoid bacilli occur in the outside world as well as in healthy and affected animals; but pure paratyphoid infections occur relatively rarely, and only sporadically or as an enzootic. It apparently requires certain factors to induce disease processes in the animal, which results in an increase in virulency of the organism outside the animal body.

SYMPTOMS.

The first symptoms noticed are dullness, diminished desire for food and a rise of temperature which varies from 103° F. and upwards; from about the third or fourth day the temperature shows a downward curve; with the progress of the disease animals become weak and debilitated and remain lying.

At the commencement there may be constipation, but in most cases diarrhœa occurs sooner or later, the fæces being mushy and sometimes contain blood. The fæces usually have an offensive odour. In the later stages the eyes are sunken, animal looks depressed, and there is grinding of the teeth; nasal and lachrymal discharge may be present and respirations may be hurried; there is sometimes a cough. Animals lie with their heads thrown back on the flanks. Inasmuch as cases are frequently found complicated with redwater or anaplasmosis infections it is common to find an anæmia which manifests itself in paleness of membranes and the tissues, and watery-like appearance of the blood, or a yellowish discoloration of the tissues.

COURSE.

In peracute cases, death may occur in from one to two days; as a rule, the disease lasts for about four to eight days, but even severely affected animals may recover. In subacute cases, the condition may last for three to four weeks.

POST-MORTEM APPEARANCES.

The mucous membrane of the fourth stomach and portions of the small intestines or large intestines may be inflamed or hæmorrhagic; the mesenteric lymph glands in the affected

part of the bowel are usually swollen and hæmorrhagic, and there is, as a rule, enlargement of the spleen. The mucosa of the gall-bladder is often swollen and the wall of the gall-bladder thickened and infiltrated, and the bile syrupy in consistence and of a golden yellow colour. The liver is enlarged, often yellowish in colour, and sometimes mottled in appearance. Small necrotic foci, ranging in size from a poppy- to a hemp-seed, are sometimes present in the liver in cases of a less rapid course.

Pneumonic areas may be present in the lungs with fibrinous deposits on the serous membranes, croupous deposits in the air passages, and consolidated areas in the middle and anterior lobes. In other cases the symptoms are those of calf pneumonia. The lungs show a red hepatisation of the anterior and middle lobe with necrotic foci in the hepatised lung; usually in such cases there is a catarrhal enteritis, but swelling of the spleen may be absent.

DIAGNOSIS.

A thorough bacteriological examination is necessary. In living animals blood is collected for the presence of the bacillus by bleeding into one per cent sterile sodium citrate bouillon, from which subcultures are made.

A bacteriological examination of the liver, spleen, intestines and mesenteric lymph glands is also made; small pieces of these should be collected fresh and forwarded without the addition of preservative. Agglutination tests are of much less value in diagnosis.

PREVENTION.

(1) Preventive inoculation is employed in some countries with satisfactory results. This consists of the inoculation of 10 to 15 c.c. of an anti-serum or a killed culture. The latter does not appear to have given satisfactory results on heavily infected farms. Sometimes a living culture is inoculated and the reaction controlled by anti-serum. If used at the onset of the disease in large doses of from 40 to 50 to 100 c.c., anti-serum is said to exert a curative action.

(2) Other preventive measures consist in the disinfection of infected calf-bomas, preferably by burning; erection of new bomas on a clean site, and isolation of infected calves. Dipping of calves and their mothers as a preventive of tick-borne diseases is recommended.

It should be recognised that calves in good condition stand a better chance of withstanding this and other diseases, and that it is impossible to rear strong and healthy calves from dairy cows unless the former are kept under hygienic conditions and given a liberal supply of whole milk at short regular intervals. Most cows are expected to supply sufficient milk for both their calves and for the creamery. The experience is that calves on dairy farms are more likely to get too little than too much milk and at too long intervals; the result being digestive disturbances, lowered vitality and susceptibility to intestinal bacterial infections.

In addition, calves exposed to tick infection contract several tick-borne diseases during early life, resulting in lowered vitality and pathological changes in the intestines and other organs which favour the setting up of intestinal bacterial infections.

BOVINE LYMPHANGITIS.

This is a chronic disease of cattle characterised by purulent inflammation of the superficial lymph glands and lymphatic vessels.

Bovine lymphangitis does not appear to be very prevalent in this Colony.

Cause.

Investigations into the etiology of the disease in Kenya Colony showed that the causal agent is a streptothrix similar to that described by Nocard in 1888 as *Streptothrix farciminosis*.

The term " streptothricosis " is usually applied to diseases produced by fungi which microscopically show thread-like filaments undergoing true branching and which propagate by division as well as spore formation.

Mode of Infection.

Under natural conditions the virus probably gains entrance through wounds which originate from various causes; the lesions of the skin caused by bites of ticks belong to the genus *Amblyomma* and *Hyalomma* are considered to be in some cases the starting point of infection.

Symptoms.

The lesions chiefly occur on one of the limbs, but they may occur in other parts of the body, e.g. the head and neck, mammary glands and lungs. They usually start from a small

sore and extend along the course of the lymphatic vessel, which appears as a cord-like swelling; small nodules appear along the lymphatic vessels; these may subsequently become soft, and on incision are found to contain a white cheesy-like purulent material, or if connective tissue formation occurs, the nodules become hard and firm with sometimes a caseating centre; the involved lymph glands become enlarged and appear as firm swellings with usually a suppurating centre. The course of the disease is slow and it may be many months before the animal commences to lose much condition. Eventually, weakness and emaciation set in, apparently from the absorption of the toxins which are formed by the organism, and death occurs from cachexia.

TREATMENT.

Excision of the tumours and cauterisation of the surrounding tissue may be of assistance in the early stage, when the disease process is localised, but as a rule recurrences occur. Usually treatment is not hopeful.

PREVENTION.

As a preventive measure, dipping in an arsenical dipping fluid, particularly with a view to the destruction of adult *Amblyomma* and *Hyalomma* ticks, is indicated.

Slaughter of affected animals, burning of the carcass, and disinfection of sheds occupied by infected cattle, should be carried out to prevent spread of infection.

STREPTOTHRICOSIS.

This disease has been observed in cattle, horses and sheep.

CAUSE.

The causal organism, called a " streptothrix," lives naturally in the soil, from whence it is transmitted to the skin of animals by some agent or agents as yet undetermined, or the starting point of infection is lesions caused in the skin by tick-bites.

INCUBATION PERIOD.

No definite information is available on this point, though it is surmised that the period is a lengthy one.
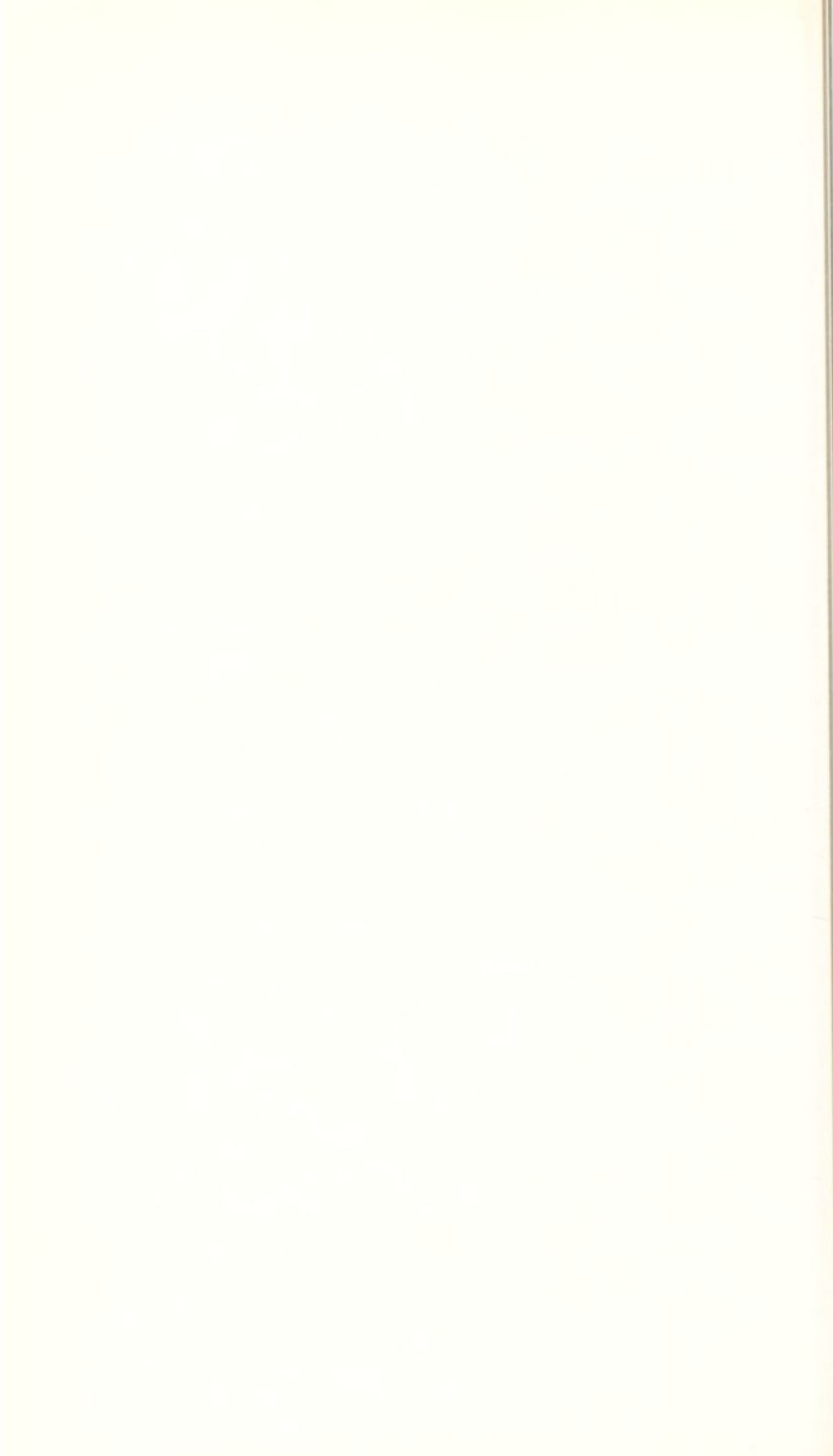
SYMPTOMS.

In cattle, most cases have been observed in adults, both poor and well-conditioned alike. The most common site for the first appearance of the disease is on the trunk and usually on the back, head and neck. The limbs, as a rule, remain
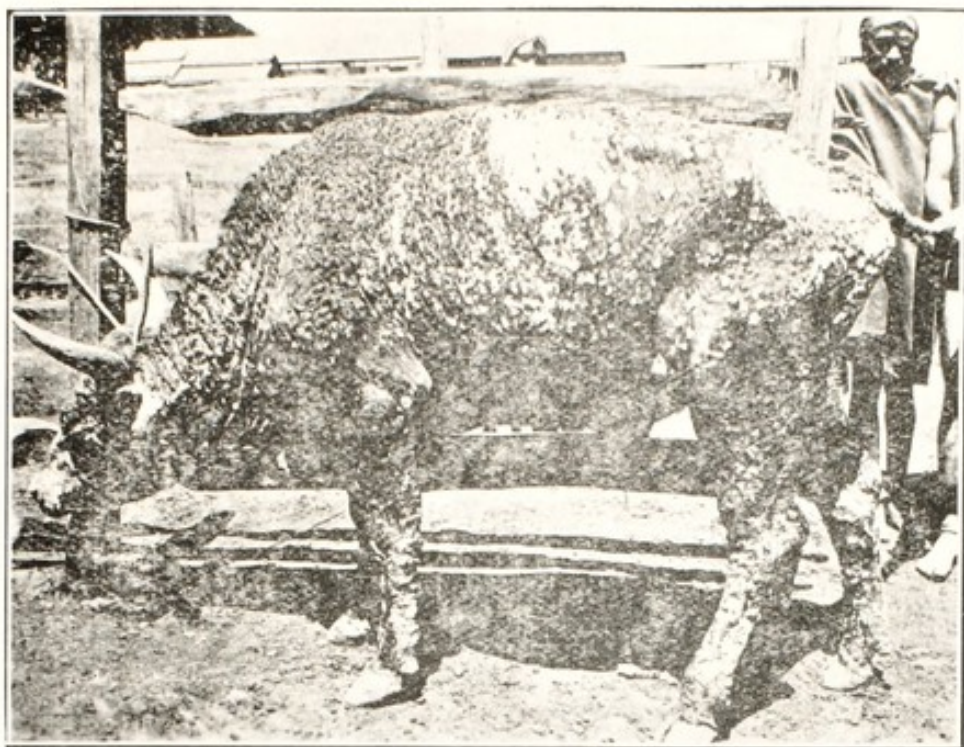
STREPTOTHRICOSIS—OX.
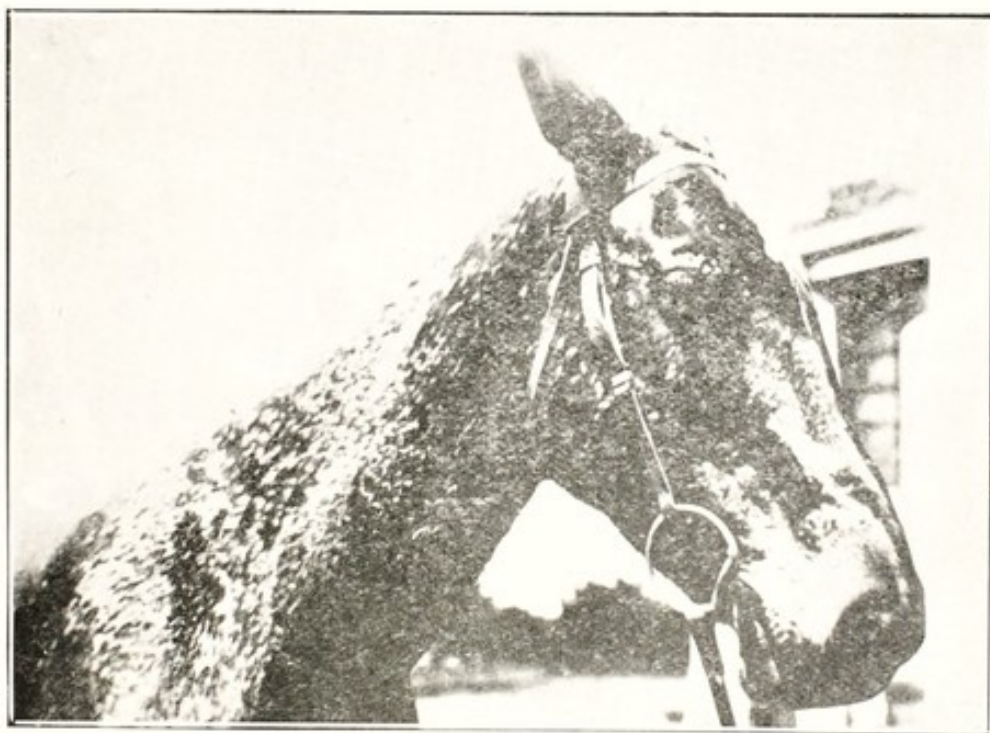
STREPTOTHRICOSIS—HORSE.

unaffected. The first symptom is the development of a small elevated point of the epidermis, which usually escapes detection until other similar points arise in close proximity. These points, at first isolated and few in number, gradually coalesce and extend over large areas of the skin, and in extreme cases cover the whole hide from head to tail. On removing the crusts of these lesions, the underlying surface will show a number of projections which fit into corresponding depressions of the crusts. The duration of the symptoms extends over a lengthy period as a rule.

TREATMENT.

In equines, a cure has been effected by removal of the crusts with a curry comb and a three per cent copper sulphate well rubbed into the skin daily after removal of the crusts. Treatment should extend over a period of several weeks. Except in the case of valuable animals, treatment is not recommended.

In cattle, dipping seems to be successful in some cases. As a curative, and in preventing the spread of the disease in the latter case, the beneficial effects of dipping are probably due to the animals being kept more or less free of ticks.

DIFFERENTIAL DIAGNOSIS.

This condition is readily distinguishable from mange by the elevated and isolated appearance of the crusts, and by microscopic examination of the lesions.

HEARTWATER.

Bulletin No. 25/1928 deals fully with heartwater and may be obtained on application from the Chief Veterinary Research Officer, P.O. Kabete. The disease is thus only briefly dealt with hereunder.

Heartwater is a disease occurring in cattle, sheep and goats and is transmitted by a tick. On the basis of our present knowledge, it is one of a group of diseases occurring in man and animals to which the name rickettsia has been given, and in which small bacterium-like intercellular organisms are found in various organs.

Heartwater in cattle, sheep and goats is scientifically known as *Rickettsia ruminantium*. The goat is most susceptible, then sheep; cattle are less susceptible than sheep. The Persian sheep, although susceptible, appears to have some resistance.

The disease is known to be fairly prevalent on areas where the ticks which are responsible for heartwater transmission breed freely ; the class of animal amongst which losses are most severe is that born and reared on non-infected grazing and removed to a heartwater infected area ; in such the mortality in cattle may amount to at least 20 per cent ; in sheep and goats the losses may be still greater, viz. 50 per cent to 80 per cent.

Transmitting Ticks.

Two species of ticks belonging to the genus amblyomma, viz. *A. hebræum* and *A. variegatum*, are known to transmit heartwater. The adults of each species have characteristic colourings on the scutum.

Incubation Period.

After natural infection, is about eleven to eighteen days. After inoculation the average period is about nine days.

Symptoms.

General speaking the symptoms are more pronounced in sheep and goats than in cattle.

One of the commonest is a high temperature ; about eleven to eighteen days after the bite of an infected tick a temperature reaction sets in. There is usually a sharp rise to 105° F. or higher. The rise of temperature may be the only symptom and the animal suddenly dies although seemingly quiet healthy ; usually the temperature keeps on rising (in fatal cases it usually drops to sub-normal before death) the respirations become accelerated, the animal appears dull, and although rumination ceases the animal will generally feed a little up to shortly before death.

Diarrhœa may set in and fæces and urine be passed at frequent intervals.

In some cases nervous symptoms which manifest themselves in different ways appear, viz :—

(1) A constant movement of lower jaw and tongue.

(2) Muscular twitchings.

(3) Vertigo. The animal turns round in circles and eventually drops in a fit. These fits disappear and recur, particularly if the animal is driven or hustled.

(4) Squinting.
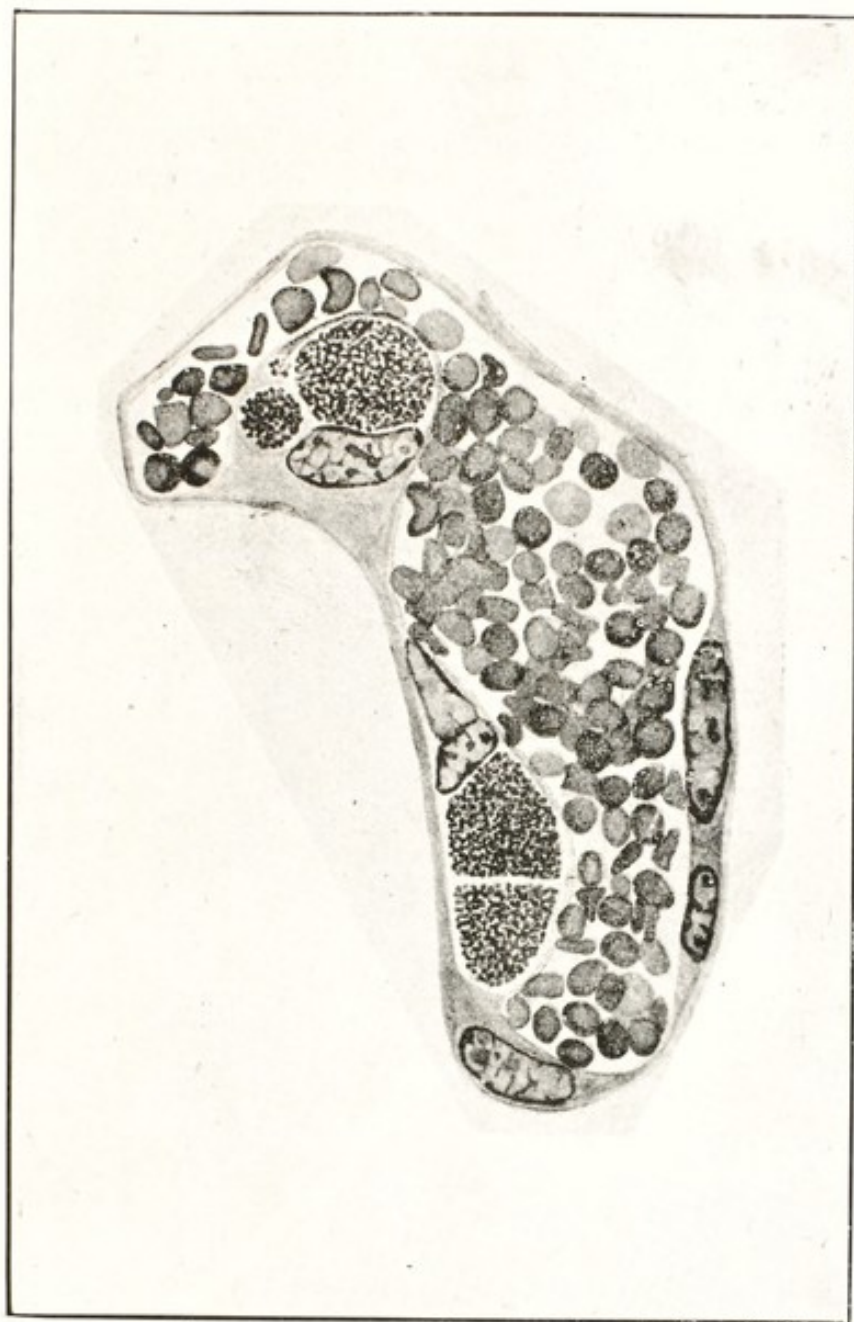
HEARTWATER—KIDNEY OF GOAT, SHOWING
RICKETTSIA.

BLACK

REDDISH-YELLOW
BORDERED
WITH GREEN.
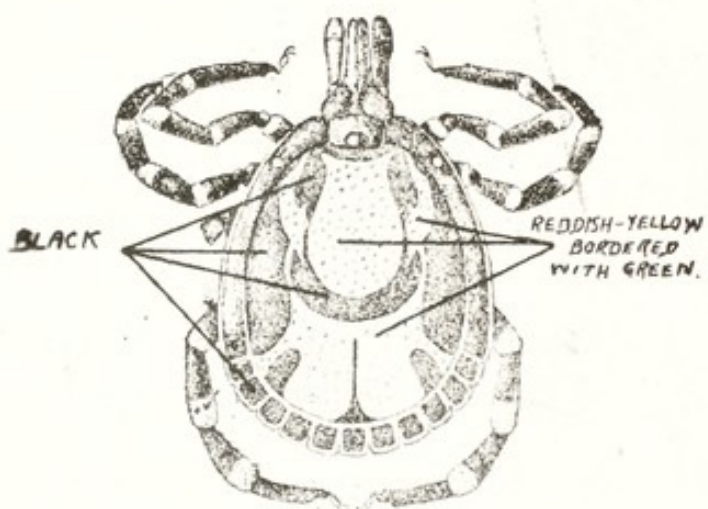
Amblyomma variegatum.
(male)
All dark areas are black,
the light areas are reddish-
yellow bordered with green.

HEARTWATER—AMBLYOMMA VARIEGATUM TICK
CARRIER OF HEARTWATER.

(5) Coma. The animal lies on its side outstretched and remains in this position for a day or more.

In cattle the temperature reaction corresponds with that observed in sheep and goats. The nervous symptoms are especially characterised; these vary, e.g. there may be a certain amount of stiffness in all four limbs, muscular twitchings, squinting, violent twitchings of the eyelids, inco-ordination of movements and turning in a circle.

POST-MORTEM APPEARANCES.

The name heartwater suggests a characteristic condition, viz. the presence of fluid in the heart sac.

Although this is more constantly met with in sheep and goats than in cattle, it is not constantly found in either (in cattle the fluid is more commonly found in the chest cavity than in the heart sac); the heart sac contains a variable amount of clear yellowish or sometimes blood-stained liquid, which coagulates on exposure to the air. It must be pointed out that fluid in the heart sac does not necessarily signify death from heartwater, as fluid is more or less common in worm-infected sheep and goats, but here it is usual to find the animal in poor condition.

The *chest cavity* may contain a variable quantity of straw-coloured or blood-stained fluid which coagulates on exposure; on incising *the lung* in some instances a good deal of frothy fluid escapes from the cut surface and it is not unusual to find in such cases froth in the bronchi and wind-pipe and at the nostrils and the interlobular tissue of the lung infiltrated with a straw-coloured fluid, particularly at the lower part of the lobes; the lining membrane of the inside of the wind-pipe often shows hæmorrhages; on the outside of the *heart* hæmorrhages in the form of small reddish points about the size of a pin-head or larger are often present and on the membrane which lines the cavities of the heart, it is usual to find hæmorrhages in the form of reddish stripes or patches.

The spleen is usually enlarged and the pulp soft and dark in colour.

The liver is usually congested and the gall-bladder distended with bile.

The kidneys are usually congested.

The mucous membrane of the *fourth stomach* may show reddish inflammatory patches and that of the intestines reddish patches or stripes.

In *cattle* the port-mortem appearances are usually less characteristic, the lesions sometimes being chiefly confined to the fourth stomach and intestines. In such mucous membrane of the stomach shows reddish patches and that of the intestines reddish patches or stripes and pin-point hæmorrhages; the hæmorrhagic nature of the inflammation in the fourth stomach and intestines may be so pronounced that poisoning by an irritant poison such as arsenic or a vegetable poison may be suspected.

DIAGNOSIS.

Although the symptoms and post-mortem appearances may be characteristic it is desirable to establish the diagnosis by laboratory methods; this can be confirmed with some certainty by microscopical examination of stained sections of the brain, kidneys or spleen provided the material is collected, preferably, during the temperature reaction; failing this, immediately before or after death.

The rickettsia of heartwater are more commonly found in the above-mentioned organs, but their presence and the organs in which they occur is related to the temperature reaction.

They are usually to be found on the second or third day of the temperature reaction in the above-mentioned organs, but difficult to demonstrate a few hours after death.

When obtaining material for despatch to the laboratory, small pieces of brain, kidneys or spleen about two inches square should be collected, preferably during the temperature reaction, failing this before or after death, and immediately after collection placed in formalin solution, a supply of which can be obtained from the Veterinary Research Laboratory, or the District Veterinary Officer, and forwarded in the formalin solution.

Another method of making a diagnosis is by inoculating a susceptible sheep or goat with blood of the suspected affected animal. The incubative period of heartwater from blood inoculation varies from about three days or rather less to about nine days, consequently the employment of this method necessitates a delay of at least some days; moreover the blood should be collected during the temperature reaction and inoculated without delay, as it soon loses its virulency : this method thus has its disadvantages.
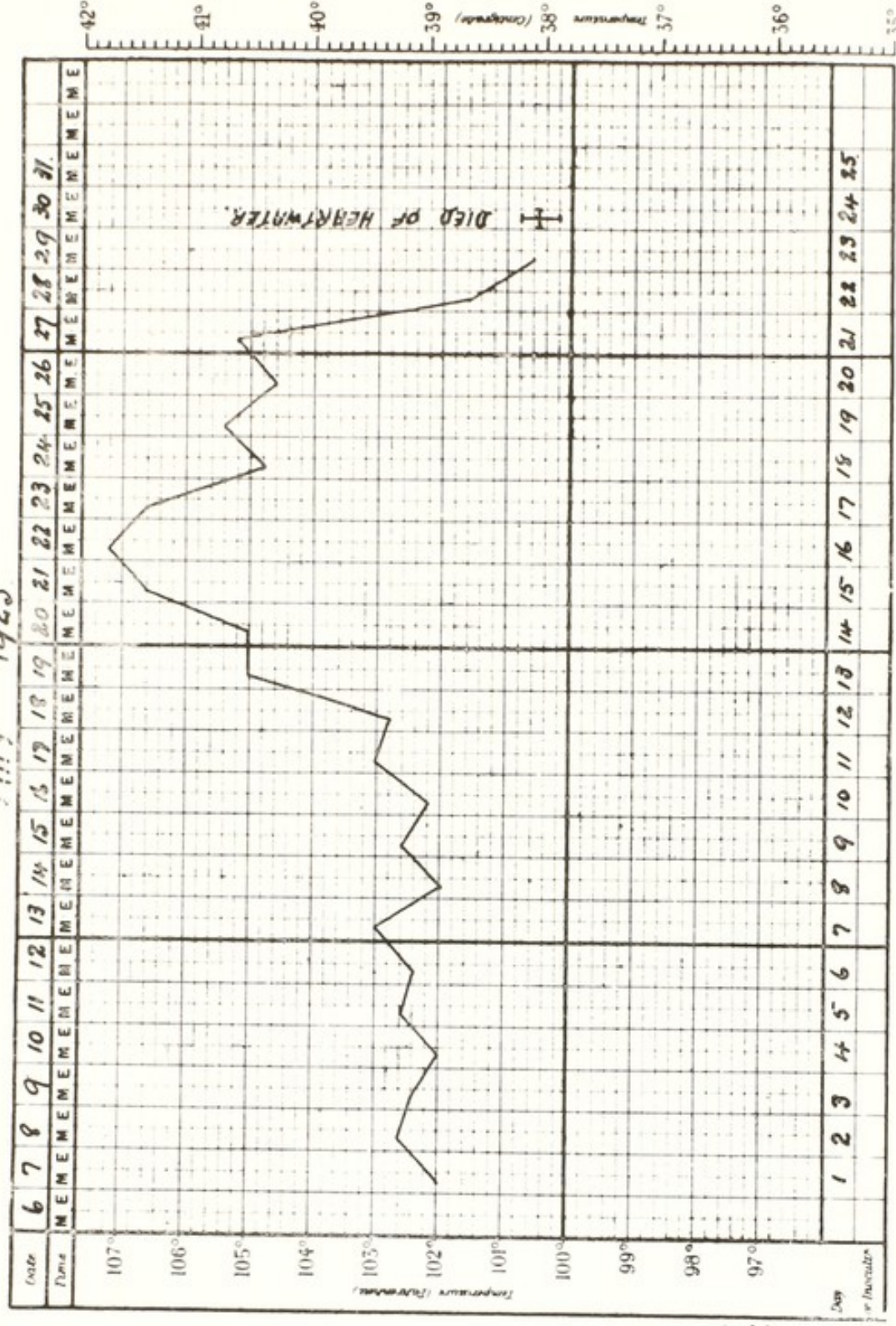
Disease:

Number: 2417

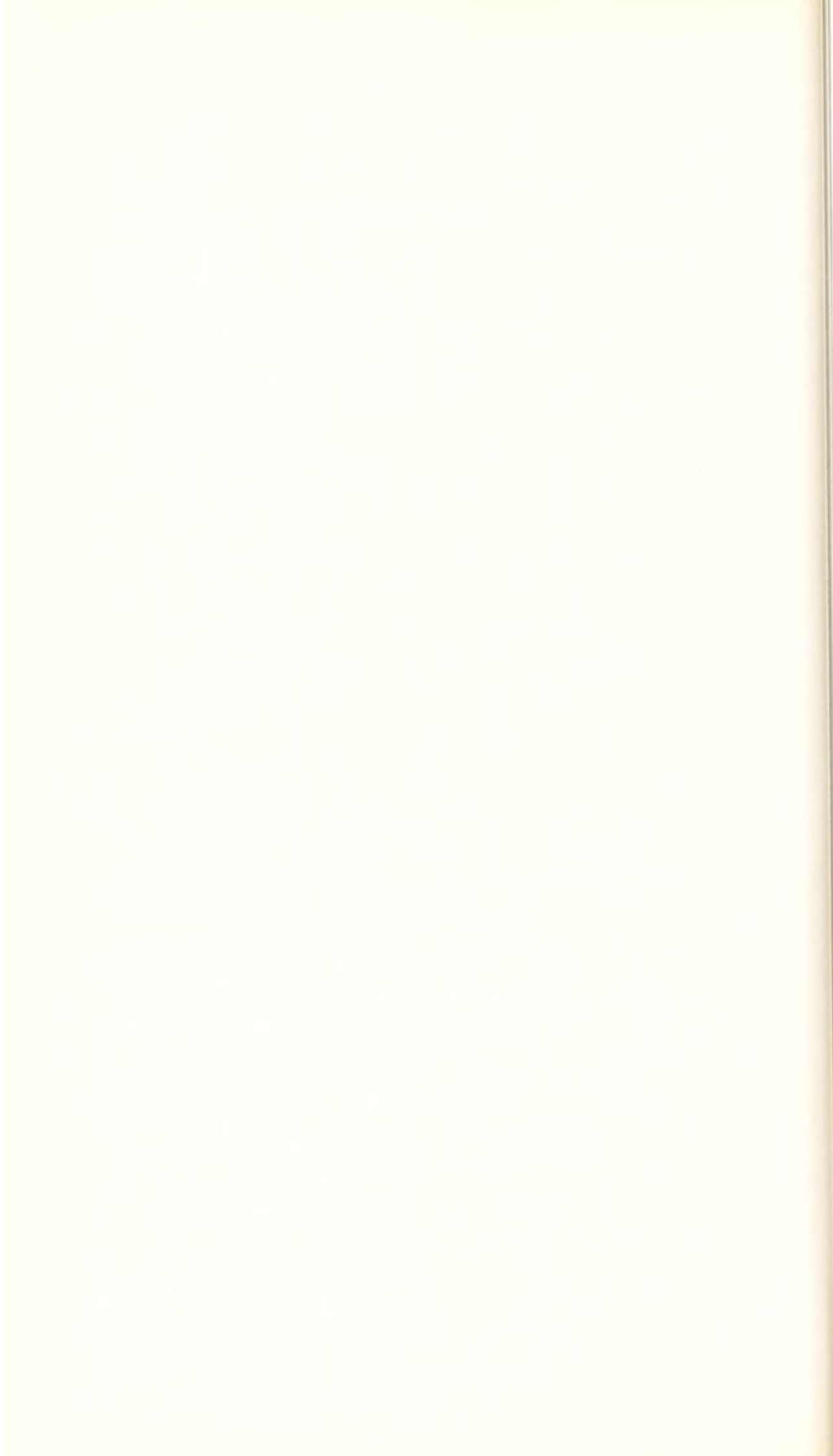Description: SHEEP

Remarks:

HEARTWATER
TEMPERATURE
REACTION.

ANIMAL EXPOSED
TO NATURAL
INFECTION FROM
MAY 6TH, 1925.

HEARTWATER TEMPERATURE REACTION—NATURAL INFECTION.

To face page 74.

TREATMENT.

Medicinal treatment has so far proved to be of little if any assistance. Affected animals should be isolated and left undisturbed and kept in a cool place sheltered from the sun and rain.

PREVENTIVE MEASURES.

At the present stage of our knowledge, dipping and hand-dressing for the eradication of heartwater ticks offers the best means of combating this disease. These measures are fully dealt with in Departmental Bulletin No. 25/1928 on Heart-water.

TRYPANOSOMIASIS OR " FLY DISEASE ".

Most of our domestic animals are susceptible to this disease as well as numerous species of game. It is not enzootic in in the highlands of the Colony, but sporadic outbreaks occur from time to time. It is sometimes difficult to trace the source of these epizootics, but two known sources are often in threatening proximity, viz. infected game and cattle imported from areas where the disease is enzootic.

CAUSE.

The causal organism, called a trypanosome, infects the blood-stream and organs of affected animals.

MODE OF TRANSMISSION.

The transmission of the disease from an infected to a healthy animal is effected naturally through the agency of blood-sucking flies. The transmission may be either direct (mechanical) or indirect (cyclical), that is to say, in direct transmission the infection is sucked by the fly from one animal and immediately or very soon afterwards injected by the fly into another animal. It is considered that most of the common blood-sucking flies are capable of so transmitting the disease. On the other hand, in indirect transmission the tsetse fly only is incriminated. This fly, of which there are many species, lives, as a rule, in well-defined areas called " fly-belts," which, as far as we know, are non-existent in the upper highlands of East Africa, though our knowledge in this respect is not very complete.

INCUBATION PERIOD.

This varies according to the type of trypanosome which infects the animal. It should be noted that there are many different types of trypanosomes, each of which varies from the others in many characteristics, e.g. in incubation period, symptoms produced, classes of animals most susceptible, etc.

SYMPTOMS.

In view of the above, it will be seen that there are no symptoms which can be regarded as typical for the disease as a whole, but one constant sign in most forms is rapid emaciation and weakness. It is not advisable to define each group of symptoms in this pamphlet, as by doing so, the lay reader may only be led to confusion.

POST-MORTEM LESIONS.

These again vary according to the type of the infecting trypanosome, but in some cases the one and only fairly constant change is the enlargement of the spleen which may or may not be accompanied by an emaciated carcass.

TREATMENT.

Curative treatment is not recommended. Affected animals should be slaughtered at once and suspects kept strictly under observation until diagnosis is established.

B.—DISEASES OF EQUINES.

HORSE-SICKNESS.

This disease is usually seasonal; it is most commonly met with during and immediately after the rainy months. It occurs most frequently in low-lying moist localities.

Donkeys appear to be immune; the Somali or native mule has a high degree of natural resistance, while the Somali pony is more rarely attacked than the country-bred or imported horse.

CAUSE.

The causal agent is an ultra-visible virus which is generally considered to be transmitted by a winged insect.

INCUBATION PERIOD.

The disease usually develops after a period of incubation varying from six to eight days.

SYMPTOMS.

Two forms of the disease are known, viz. (a) the acute, and (b) the sub-acute; the former being known in South Africa as dunkop and the latter as dikkop.

In the acute form the temperature rises rapidly to 106° F. or over. The animal may show only slight signs of dullness and retains its normal appetite for a few days. At the

height of the disease, however, the animal is exceedingly feeble, the pulse quickened, the heart throbbing, the breathing accelerated and laboured. In a very small percentage of cases improvement and subsequent recovery takes place in the course of the second week. In most cases, however, a short time before death œdema of the lungs develops, the breathing becomes more laboured and large quantities of yellowish white foam flows from the nostrils. Death is generally sudden and often preceded by symptoms resembling those of colic. Should the horse be made to exert itself during the course of the disease he may drop dead.

In the sub-acute form horse-sickness develops much more slowly. At the height of fever or possibly later the depressions above the eye become puffed; the eyelids may also swell and become everted, or in some cases the whole head may appear swollen and the lips hang loosely from the mouth. Swellings may also be noted on the chest, abdomen, and legs. (Note.— All these swellings are soft to the touch.) In the meantime, weakness develops and the animal appears very sluggish; in a number of cases, however, a recovery is made.

Post-Mortem Lesions.

The lesions vary according to the type the disease assumes.

In acute cases the most marked changes are found in the lungs and digestive tract. The lungs, as a rule, fill the whole chest cavity, they are dark in appearance, very friable and full of foam (œdema). In addition to this a large quantity of straw-coloured fluid is found in the chest cavity. The inner lining of the stomach and intestines reveal varying degrees of inflammation and œdema. The spleen is swollen; the liver is congested and numerous hæmorrhagic points are seen on the surface of the heart.

In the sub-acute form, besides the œdematous swellings in the regions described under symptoms, a more or less constant appearance is hæmorrhages on the lining of the walls of the heart cavities and frequently also on the outer walls of the heart.

Treatment.

No agent has yet been discovered which can be said to have any specific curative effect on the disease. Many people, however, claim successes with numerous drugs and herbs, but when it is considered that a fair proportion of affected animals recover naturally without intervention, it is not difficult to

realise how enthusiastic quacks and others may be deceived in their remedies. Animals reacting to horse-sickness should be kept stabled and left undisturbed.

PREVENTIVE INOCULATION.

Horse-sickness serum and virus is prepared at Kabete for the immunisation, under veterinary supervision, of horses and mules. The method employed consists of the intrajugular injection of serum and simultaneously the intrajugular injection of virus followed in seventy-two hours by another intrajugular injection of serum and intrajugular injection of virus. Full particulars of the method are obtainable from the Chief Veterinary Research Officer, Kabete.

Immunised animals are not necessarily absolutely and completely resistant against natural re-infection, but where re-infection does occur, the course of the disease is usually milder and the percentage of losses in immunised animals is lower in comparison with non-immunised animals.

NOTE.—The serum itself is of no value as a curative.

Removal of equines to an elevated part of the farm before the horse-sickness season sets in is sometimes resorted to as a preventive measure. The animals should, if possible, be kept stabled from before sunset till late in the morning.

With a view to keeping the stables free of winged insects if non-insect-proof, they are smoked from late in the afternoon until late the following morning by burning dry ox litter, moistened with paraffin, in paraffin tins. Another method of the attacks of winged insects is to rub the body of the animal when stabled with paraffin emulsion.

Of the above-mentioned preventive methods, preventive inoculation offers the best means of ensuring against severe losses from horse-sickness.

Vaccination with treated spleen of an affected horse has been investigated, with promising results.

BILIARY FEVER (PIROPLASMOSIS OF EQUINES).

All species of equines are susceptible to the infection though the virulence of the disease varies in different animals. Native-bred equines contract the disease in their early life if exposed to infection and the disease runs a milder course than in older animals which are brought from countries where the disease does not occur, to infected localities.

CAUSE.

Two species of parasites are known to be responsible, viz :—(1) *Nuttallia equi* ; (2) *Piroplasma caballi.*

These may be distinguished microscopically. The latter is the larger parasite and is somewhat similar to the redwater parasite (*Babesia bigemina*) of cattle. The *Nutallia equi* parasite is considerably smaller and resembles parasites of the genus *Theileria.* It is more widely distributed than *Piroplasma caballi*; both have been found to occur in this Colony. The disease caused by *Nuttallia equi* is more severe than that due to *Piroplasma caballi* and it is probably less amenable to treatment. In either case infection is transmitted by infected ticks. Th red-legged tick (*Rhip. evertsi*) acts as a transmitter of *Nuttallia equi.* The tick sucks the infection from an infected or recovered animal, and in another stage of its life is capable of infecting a susceptible animal. The organism multiplies in the blood and organs of infected equines and sets up manifestations of the disease. Recovered animals are carriers and serve as a source of infection for ticks.

INCUBATIVE PERIOD.

Nuttallia equi.—After artificial inoculation, varies from seven to nine days ; natural infection about three weeks.

SYMPTOMS.

The temperature varies in the different types. In *Nuttallia equi*, the fever curve is of the intermittent or recurrent type, whereas in *Piroplasma caballi* it is of the continuous type.

The first visible sign is a pale-yellow colouration of the mucous membrane of the eyes and mouth ; the intensity of this colouration is in proportion to the severity of the infection. In severe cases small points of hæmorrhage occur later in the eye membrane, and at the same time dullness is evident. The appetite is small, while thirst is increased. At first, or throughout the entire course, there is marked constipation, but in the later stages of some cases diarrhœa sets in and colicky pains arise. Urine is passed in large quantities and is reddish-brown in colour. Emaciation ensues and the limbs swell. In some cases death usually occurs in from four to five days or earlier from the beginning of the symptoms, while in a protracted case the disease lasts from three to four weeks or even longer.

Post-Mortem Lesions.

The outstanding lesion is the marked jaundice or yellow colouration of all tissues and internal organs. The spleen is swollen, and hæmorrhages are seen on the heart and other organs. Reddish coloured urine may be found in the bladder and the intestines are sometimes inflamed. Lungs are œdematous, sometimes yellowish or amber-coloured fluid is present in the chest cavity and heart sac. General anæmia is present in protracted cases.

Treatment.

Numerous recipes are in vogue as curatives, but it is extremely doubtful if any of them has a specific effect in destroying the causal organism. Trypanblue injected under the skin as in redwater of cattle (*Piroplasma caballi* appears to be more amenable to treatment with trypanblue); large doses of quinine and other drugs have found favour with some clinicians, but whatever treatment is undertaken, careful nursing and attention to the state of the bowels are the first essentials. Recovery from the disease generally means immunity, but breakdowns during other infections, e.g. horse-sickness, etc., may occur.

Preventive Inoculation (Immunisation).

Has been carried out in some countries. The immunisation of horses imported from countries where the disease did not occur, with 1 c.c. of blood of artificially infected donkey colts was employed in South Africa with fairly satisfactory results.

In other parts, blood taken from young horses recovered from the disease has been used for preventive inoculation.

LYMPHANGITIS OF EQUINES.

In this Colony two separate diseases commonly known as lymphangitis are met with. The one, viz. ulcerative lymphangitis, is the more prevalent, and chiefly affects horses; less often mules. It is doubtful if the donkey contracts it naturally. The other, viz. epizootic lymphangitis, which is nowadays not prevalent, affects both horses and mules, and rarely the donkey.

The two diseases are etiologically distinct but clinically the one is sometimes confused with the other; in exceptional cases both infections have been found to co-exist. It is advisable to confirm, or otherwise, the clinical diagnosis by microscopical examination of pus smears.

Ulcerative Lymphangitis.

This is a chronic contagious disease in which there is a progressive inflammation of the lymph vessels with a tendency to the formation of ulcers.

Cause.

The responsible microbe, viz. the bacillus of *Preisz nocard*, escapes from the suppurating ulcers and exists as a saprophyte in the soil from whence it gains entrance to the animal's body through wounds of the skin produced by various causes, e.g. harness and saddlery, injuries of the legs caused by the foot coming in contact with the opposite leg during progression commonly known as brushing, kicks, etc.; the wound of the skin caused by bites of ticks, particularly by *amblyomma* and *hyalomma* ticks, are generally considered to be the starting point of infection.

Symptoms.

The formation of a pus-containing swelling or abscess on any part of the body should arouse suspicion. A common site for the disease to develop is on the hind limbs; with antiseptic treatment the suppurating sores heal, but new ulcers occur in the adjoining affected tissue or even in distant parts of the body. Should the infection confine itself to the legs they become thickened with new abscesses forming from time to time and permanent thickening of the affected leg results.

In cases where the hind limbs are affected it is common to find in females the mammary gland involved and in males the prepuce.

Post-mortem Lesions.

Besides the lesions described above, internal abscesses are sometimes found in one or both kidneys and more rarely in the lung.

Treatment.

Various medicinal agents and vaccines have been used for the curative treatment of the disease; in addition the value of surgical treatment such as excision of nodules, cauterisation of the ulcers, firing of the affected tissues with a hot iron and subsequent application of a biniodide of mercury blister has been investigated. None of these have proved to be a specific. Biniodide of mercury blister (one of biniodide of mercury to eight of vaseline or lard) causes quick healing of the ulcers and prevents the escape of pus containing the bacilli of ulcerative lymphangitis. A vaccine is issued for experimental use only (see directions for use below). In some cases the disease would

appear to be arrested by treatment, but recurrences usually occur. In animals kept stabled and well fed beneficial results follow but as a rule these are only temporary and recurrences are likely to occur. The serum of horses hyperimmunised with killed cultures, or the serum of recovered horses has no curative effects. Generally speaking, treatment is not hopeful; in cases where there is chronic thickening of the leg the affected animal is often practically unworkable owing to lameness.

Prevention.

Since the organism gains entrance through lesions of the skin produced by various causes, it is recommended that such be dressed with an antiseptic such as tincture of iodine or lysol 2 per cent. Particular attention should also be given to the disinfection of saddlery, harness, body-brushes and curry-combs used on infected animals. In animals which are running on tick-infested grazing, dipping reduces the lesions of the skin caused by tick bites. *Amblyomma* and *hyalomma* ticks in particular cause ulcerating sores, more particularly the adults.

It is recommended that infected equines be not kept in the stables which are used for clean animals, since the pus from ulcers contains the causal organism of ulcerative lymphangitis.

Directions for the Use of Ulcerative Lymphangitis Vaccine.

NOTE.—This vaccine is issued for experimental use only.

1. For this inoculation a series of weekly injections is necessary and care must be taken to ensure regular intervals of time between each injection.

The doses are as follows :—

First week	... ...	$\frac{1}{2}$ c.c.
Second week	... ...	1 ,,
Third week	... ...	1 ,,
Fourth week	... ...	$1\frac{1}{2}$,,
Firth week	... ...	$1\frac{1}{2}$,,
Sixth week	... ...	2 ,,
Seventh week	... ...	2 ,,
Eighth week	... ...	$2\frac{1}{2}$,,
Ninth week	... ...	$2\frac{1}{2}$,,
Tenth week	... ...	3 ,,
Eleventh week	... ...	4 ,,
Twelfth week	... ...	5 ,,
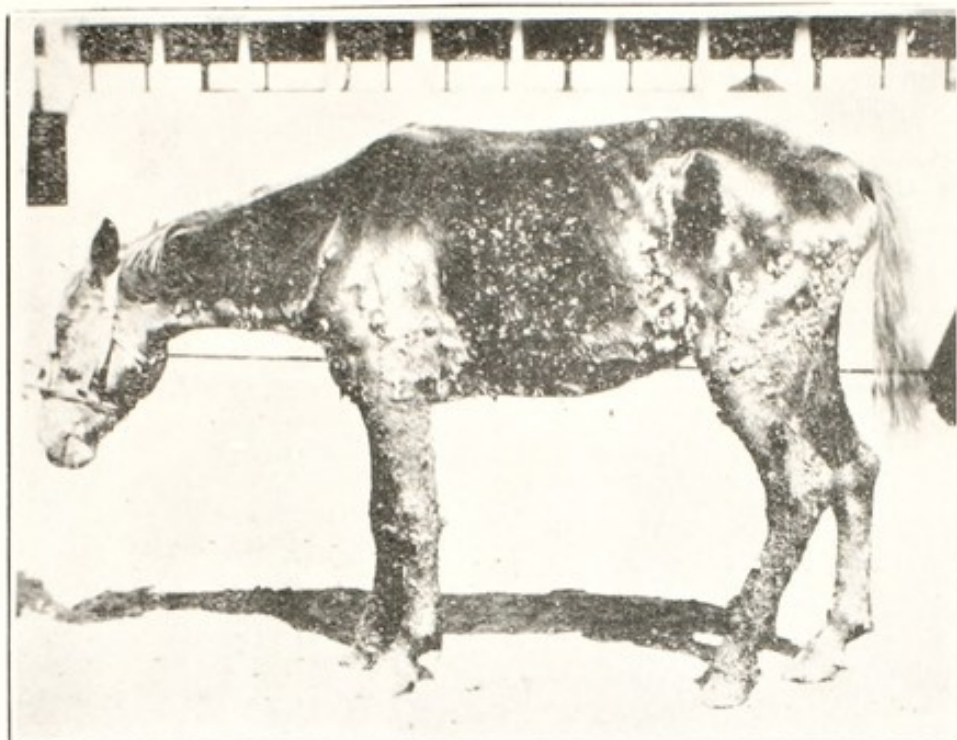
ULCERATIVE LYMPHANGITIS—HORSE.

EPIZOOTIC LYMPHANGITIS—HORSE.

2. The injection is made with a sterile syringe (needles and syringe being sterilized by boiling in water for five to ten minutes), into the tissues beneath the skin on the side of the neck. The hair should be clipped from the site of inoculation and the part thoroughly cleaned by washing with a suitable antiseptic, e.g. 2 per cent lysol or carbolic solution. The injection should be made on alternate sides of the neck each week.

3. This vaccine could be tried in recently affected animals. It is not considered to be of much benefit in reducing chronic cellulitis or other old-standing lesions resulting from prolonged action of the causal organism of the disease.

4. If any extension of the disease appears after six injections, treatment should be suspended for a month, and recommenced with small doses.

5. Pus smears from the lesions should be forwarded periodically for diagnosis, in order to eliminate other bacterial infection.

6. During treatment animals should receive their usual rations and full exercise or light work.

Epizootic Lymphangitis.

Epizootic lymphangitis is a chronic disease of equines, characterised by purulent inflammation of the lymph vessels and their associated lymph glands.

Cause.

This is an organism scientifically known as *cryptococcus farciminosus* which shows some of the characters common to the yeast fungus. The organism can be detected microscopically in the pus smears of affected animals. It can live as a saprophyte in the soil from whence it gains entrance to the body through lesions of the skin produced by various causes.

Symptoms.

The incubation period recorded by various workers varies considerably, viz. from fifteen days to 120 days, and even longer; the average incubation period is usually several weeks. In the early stages, it is in some cases difficult for an inexperienced observer to distinguish between epizootic and ulcerative lymphangitis. There are however apparent distinctions, e.g. in epizootic lymphangitis the disease spreads along the course of the lymphatics to the nearest lymph glands

causing the lymph vessels to stand out in the form of hard cord-like lines interrupted at various points by abscesses. The lymphatic glands increase in size and suppurate.

Lesions may appear on any part of the body but the following are the commoner sites, viz. (1) the head or neck, in which case the eye, nose and the glands under the lower jaw are most frequently involved; (2) the extremities, especially the forelegs, as well as the back, withers and sides of the chest and glands in front of the chest; (3) inside the thighs often involving the mammary gland in females and prepuce and scrotum in males. In the depth of the ulcers there develop pale-red bleeding granulations, the ulcers discharge a purulent or serous fluid. a hard swelling may appear in the immediately surrounding tissue, and nodules which later change into abscesses appear. Sometimes the ulcers heal but a hard nodule, which may reach the size of a pigeon's egg, appears which may later turn into an abscess; the ulcers are sometimes cup or mushroom shaped. In advanced cases there is usually a thickening of the surrounding connective tissue resulting in permanent thickening particularly marked in the extremities.

The above-described changes may not for a long time affect the general condition of the animal. but in very pronounced cases there is emaciation and finally death.

Course.

Although the course is always chronic, in some instances the lesions remain localised; in other cases they continue to extend for some considerable time during which the disease processes appear to subside and recur.

The mortality varies widely. Some observers record this to amount to 10 per cent, others 25 per cent, others up to 50 per cent.

Treatment.

Various remedies have been tried for the curative treatment of epizootic lymphangitis, but so far there is no known specific. Intravenous injection of biniodide of mercury dissolved in potassium iodide solution has been found of assistance by some workers when the disease is not too far advanced, but treatment is as a rule not hopeful. Satisfactory results are claimed by some workers from weekly-increasing doses of killed cultures of the causal organism particularly if accompanied by local surgical treatment. Others report a fairly large percentage of recoveries following the daily subcutaneous injection

of 10 to 20 c.c. or after 100 c.c. of serum intravenously of a convalescent animal. Others claim beneficial treatment with the serum of affected horses, 10 c.c. subcutaneously daily for ten days. The serum of hyperimmunised horses, according to some, is considered especially effective.

Prevention consists in the isolation of infected animals, destruction of seriously affected animals, treatment of slightly infected cases could be carried out, and thorough disinfection of the stables. Daily examination of equines exposed to infection and treatment of wounds of the skin with antiseptic.

C.—DISEASES OF SHEEP.

BLUETONGUE.

This is a disease of sheep principally affecting the membranes of the mouth, nose and intestines, and very often accompanied with inflammation of the feet. It is most prevalent in wet seasons, and occurs more often in low, wet places and in the vicinity of rivers.

CAUSE.

This is an ultra-visible virus, said to be transmitted by winged insects from sick to healthy animals.

INCUBATION PERIOD.

The natural incubation period has not been definitely determined. The average incubation period from artificial infection (inoculation) averages four days.

SYMPTOMS.

The first indication is a rise of temperature. Visible symptoms appear a few days later, one of the earliest being a peculiar movement of the tongue. The animal appears to lick its lips at intervals.

A watery discharge from the nose and sometimes the eyes appears later. This becomes thicker. The animal feeds little, loses condition, and mostly lies. Examination of the mouth shows a bluish or purplish discoloration, with swelling of the lips and gums and excoriations of the lips. Recovery may take place at this stage, though, on the contrary, further changes may occur, viz. the appearance of sores on the upper jaw and tongue, a thickened saliva is retained in the mouth and hangs from the lips, producing an offensive odour. There is usually a purulent discharge from the nose; diarrhœa may appear, and frequently an inflammation of the feet becomes

apparent. The sick animal is disinclined to move, and loss of condition increases. Sometimes a casting of the wool occurs. In fatal cases, death usually takes place in from ten to seventeen days after the commencement of the temperature reaction.

Post-mortem Appearances.

When death occurs in the acute stage, the mouth is found principally affected and shows excoriations of the lips and gums and sloughing of the epithelium of the tongue. Reddish patches and stripes are sometimes found in the first, second and third stomachs. The fourth stomach may be swollen, with reddish stripes, or diffusely red. There may be a catarrh of the bowels. Lungs are sometimes œdematous, with foam in the wind-pipe. Hæmorrhages are more or less constant under the lining of the left ventricle and on the outer wall of the heart. The spleen may be enlarged. The liver is usually congested and sometimes yellowish. The kidneys may be œdematous.

In cases of long standing there are usually lesions of extreme emaciation and paleness of the carcass.

Treatment.

An efficient vaccine is prepared which acts as a preventative; curative treatment is not undertaken.

It is recognised that removal of the flock from wet to high dry ground and kraaling in elevated dry places checks the spread of the disease.

Dipping in one of the proprietary tar-derivative dips is frequently resorted to as a preventative.

Instructions for Use of Bluetongue Vaccine.
The Injection of Vaccine.

1. Before commencing to inoculate, the syringe must be thoroughly sterilized; to do this, place some cotton wool or cloth in the bottom of a clean tin, basin or pan, and half fill this with water; take the syringe to pieces, unscrewing the metal cap at the top of the glass barrel; place on top of the cotton wool in the pan together with the needle, and place the pan on the fire. After the water has boiled for about ten minutes, take the syringe out and screw it up, and fit the needle to it. The greatest care must be taken to prevent the contamination of the vaccine or the syringe by dust or other foreign matter.

2. Each bottle should be vigorously shaken immediately before being opened in order to break up the clot which sometimes forms after standing. This coagulation does not affect the action of the vaccine in any way. Next obtain a clean glass tumbler or cup and wash it with boiled water; then uncork the bottle of vaccine and pour some into the cup or glass, placing a clean piece of paper over the cup or glass so that it extends about half way down and forms a cap. After pouring out the vaccine, re-cork the bottle immediately. Do not return to the bottle vaccine which has been poured into the cup or glass or which may be left over after inoculation. Beware of dust entering the vessels. Once a bottle has been opened, all the vaccine should be used the same day.

3. The sheep which are to be inoculated should be taken out of the kraal and prepared for the operation by washing the inside surface of the thigh where the vaccine is to be injected with an antiseptic solution made by adding one and a half tablespoonfuls of Jeyes' fluid or Little's dip or carbolic acid to one whisky-bottleful of water. The operator's hands should be frequently washed in the same solution.

4. The syringe should then be filled with vaccine, the needle inserted under the skin inside the thigh and 1 c.c. of the vaccine injected. The animal can then be released, but kept separate from those which have not yet been vaccinated. The needle should be replaced by a freshly boiled and sterilized needle after five sheep have been inoculated. A little uneasiness will be shown by the animal after inoculation, but this soon passes off. The syringe should be carefully washed and wiped dry before being put away after the inoculation of all the sheep has been completed.

Reaction.

5. The fever set up by the inoculation reaches its highest point about nine to twelve days after, and it lasts for a few days more.

Symptoms can be noticed about this time, lasting for a few days, viz. stiffness, not feeding, discharge from nose, swollen head. The mortality from vaccination should be below one per cent. Immunity against natural attacks of bluetongue is not established for fifteen days after inoculation. Some loss of condition may be expected after vaccination, and this may be more pronounced in some sheep than in others.

Time of Inoculation.

6. Experience has shown that the best immunity is obtained when the operation is undertaken just before the rains which mark the onset of the bluetongue season. This factor should be borne in mind when fixing the date for vaccination, always providing that the pasturage is good or that convalescent sheep are specially fed.

Special Warnings.

7. Ewes in lamb must not be inoculated. Lambs of six weeks to six months of age should receive a half-dose of vaccine; rams should not be castrated whilst undergoing reaction, nor should castrated animals be inoculated before the wounds caused by the castration have completely healed.

8. Sheep undergoing reaction or convalescence should not be dipped.

9. When a farmer has no experience with the bluetongue inoculation he should first inoculate a small flock of sheep, about twenty or twenty-five, before he inoculates the whole lot, in order to make himself familiar with what he has to expect. This is particularly advisable under conditions where the vaccine is used for the first time in a new district, and where no experience of bluetongue vaccination is obtainable.

Immunity.

10. The immunity conferred by vaccination is not absolute, and breakdowns may occur. They occur to a lesser extent in flocks vaccinated shortly before the outbreak of bluetongue. Sheep should be inoculated every year.

11. In case of outbreaks of bluetongue amongst non-vaccinated flocks, when the disease is rampant inoculation should be resorted to with the object of saving as many animals as possible. Experience has proved that it will assist in preventing the disease in animals not visibly affected.

When and how to obtain the Vaccine.

12. Vaccine may be obtained on application being made to the Chief Veterinary Research Officer, at the Veterinary Research Laboratory, P.O. Kabete, and can only be issued on receipt of full payment accompanying the order.

13. The vaccine should be unpacked immediately after arrival, examined, and if any bottles show leakages or have broken corks, they should be returned and immediate notice given of any discrepancy.

Where to obtain Syringes.

14. Syringes for inoculation are not sold by this Department. Any of the chemists in Nairobi will supply these on application being made; inquiries have elicited the information that these are stocked by them. Syringes which are provided with a graduating wheel on the plunger bar are recommended as being the most convenient for use. With care these syringes will last for several years.

Conditions under which the Vaccine is Issued.

15. The utmost care is exercised in the preparation of the vaccine, but no guarantee is given, nor will compensation be paid for deaths or accidents which may follow its use. The vaccine should be used as soon after receipt as possible.

Sheep-owners are strongly advised not to keep any stock on hand, as unless vaccine is kept in a very cool, dark place there is danger of deterioration, and it is recommended that no vaccine be employed which was issued from the Laboratory more than three months previously. The Laboratory cannot undertake to exchange any vaccine which has once been issued.

In the event of any complaint, the number and date on the bottle should invariably be quoted.

SHEEP POX (*VARIOLA OVINA*).

Sheep pox is an acute febrile infectious disease characterised by a vesiculo-pustular eruption which occurs on the skin and sometimes on the mucous membrane.

OCCURRENCE.

Outbreaks of this disease are reported from time to time in woolled sheep in this Colony and rarely in goats.

ETIOLOGY.

Sheep pox virus is ultra-visible and filtrable.

RESISTANCE OF THE VIRUS.

The virus is considerably resistant to external influences, and instances have been recorded where susceptible sheep, which grazed over pasture on which infected sheep had been pastured approximately two months previously, contracted the disease. The contagion remains virulent in the dried scabs for several weeks at least.

Natural Infection.

Occurs when healthy sheep are put in contact with affected or not entirely recovered sheep. The virus probably enters the lungs with the inhaled air and passes to the blood and thence, through the latter, to the skin and mucous membranes; if the food or ground is contaminated the virus is inhaled with the dust which arises through the movement of the sheep. Infection may be transmitted by attendants, infected skins, wool, feed, pasture, etc. Young sheep are more susceptible than older sheep and the disease is usually more severe in lambs.

Symptoms.

After an incubation period of about eight days, a pox eruption arises. There is in the initial stages a rise of temperature. There is usually a discharge from the eyes and nose; a day or two later, round red spots appear on the skin, usually of the lips, nostrils. They may also appear on the vulva, udder of females, and prepuce and scrotum in males, and on the insides of the thigh. Next day small reddish nodules appear in the middle of the red spots, and a vesicle forms. This contains a clear yellowish serous fluid. A slight depression occurs on the top of the vesicle and two or three days later the clear yellowish fluid contained in the vesicles turns cloudy; the vesicles subsequently become dried and scabs are formed; the scabs eventually drop off.

With the appearance of the eruption the symptoms subside, animals appear bright, and feed; the secretion from the eyes and nose continues. There is usually a good deal of salivation. Later, the general condition becomes worse, but with the drying of the vesicles the animals soon regain their normal health.

The eruption develops similarly on the mucous membrane; when present in the mouth there is usually marked salivation and if present in the pharynx there may be difficulty in swallowing.

Post-mortem Appearances.

Sheep dead of sheep pox reveal as a rule besides the changes on the skin, hæmorrhages of the mucous membrane of the air passages and of the stomach and intestinal tract. The lungs may contain small nodules. Pyæmia and septicæmia changes may be present in the internal organs (liver, kidneys, etc.), which manifest themselves in paleness of the organs (fatty degeneration).

COURSE.

The average duration from the commencement of the development of the eruption until the dropping off of the scabs is about three to four weeks. The disease in this Colony runs a mild course and no serious mortality has been recorded, but in other countries serious losses have been recorded. After the appearance of an outbreak in the flock, cases first appear at about a fortnight's interval; later, however, in more rapid succession. In some cases only a few animals at first become affected, and only three or four weeks later a large number of the sheep of the flock are found affected, and generally after a further interval the remainder of the flock are affected.

DIAGNOSIS.

The diagnosis can be confirmed by scarifying on the inside of the thigh of a susceptible sheep some lymph from a suspected case, or the dried scabs may be ground up in a mortar and scarified on the inside of the thigh. In this way it is possible to differentiate sheep pox from other skin eruptions, e.g. pustular eczema, etc.

PREVENTIVE INOCULATION.

A vaccine for the immunisation of sheep is prepared at the Veterinary Research Laboratory and has been used successfully during the last few years.

SHEEP SCAB.

Sheep scab is more or less prevalent. Living in flocks, and boma-ed at night, which is the rule with ovines, facilitates spread of contagion and perpetuation of the disease.

CAUSE.

This is a small parasite, scientifically known as *Psoroptes communis*, var. *ovis*, which infests the regions of the body covered with wool and the inside of the ears. The adults can just be seen with the naked eye; with a magnifying glass they are quite easily detected on the affected parts of the body.

THE LIFE HISTORY OF THE PARASITE.

The eggs of the fertilized and mature female when in contact with the skin hatch in two days, and in three days when one millimetre from the skin.

The larvæ, when hatched, attack the skin very quickly, and after feeding about thirty-six hours become quiescent and usually change into nymphæ in two, and always within three, days.

The nymphal stage lasts from three to four days and is succeeded by the adult stage.

The adults feed for a short time and pair, and in from usually twenty-four to twenty-eight hours the pubescent female changes into an ovigerous female.

After moulting, the ovigerous female commences to feed, and usually starts to lay eggs about twenty-four hours after moulting. The nine days' interval was established as just being within the life-cycle of the *Psoroptes communis ovis* (psoroptic scabies of the sheep) in South Africa.

DESCRIPTION OF THE DIFFERENT STAGES.

The ova (eggs) are creamy-white in colour, oval in shape, with a smooth and shiny surface.

The larva has three pairs of legs, the third pair terminating in two long bristles.

The nymph has four pairs of legs; at the apex of the fourth pair there is a pedicle with a sucker and a bristle.

The pubescent female resembles the nymph, but can be distinguished by the following :—

The fourth pair of legs are terminated in two long bristles, pedicles absent, and by the presence of a large vulvo-anal slit and two copulatory tubercles.

The ovigerous female.—The fourth pair of legs each have one sucker and one long bristle at their apexes. It possesses a large sub-thoracic vulva which is absent in the pubescent female. The *adult male* has the third pair of legs very long and terminated by a sucker and a long bristle.

The adult female measures about one-fortieth of an inch in length by one-sixtieth of an inch in breadth, and the adult male one-fiftieth by one-eightieth of an inch.

SYMPTOMS.

The earliest symptom noticed as a rule is a disposition to bite or scratch the affected parts or to rub against posts, fences or other objects.

When the disease exists only to a slight extent in a few sheep it may escape observation unless the flock be watched patiently for some minutes, when the animal will be noticed to bite or scratch itself, and when caught and examined the wool over the affected part and some tufts of wool will be

found to have been pulled out, giving the fleece in this position an uneven appearance. On rubbing the affected parts with the fingers the animal extends the head and moves the lips and jaws. When infection exists in parts of the body which cannot be reached by the mouth, e.g. the shoulders and neck, dirty stains will be observed on the wool by the animal scratching the part with the hind feet.

On parting the wool where the animal has been biting or scratching, and the underlying skin examined, the parasites can be detected with the naked eye by those accustomed to examine for scab as small whitish objects.

As stated above, no difficulty should be experienced in detecting them with a hand lens. The initial symptoms described above may be due to other causes, e.g. the presence of various species of sheep lice, ticks, grain seed, or to a nonparasitic infection of the sebaceous glands; a dermatitis, particularly of the back and loins, sometimes occurs in wet weather, especially in lambs, which may be confused with scabies.

The existence of psoroptic scabies should thus be confirmed or otherwise by searching for the causal parasite.

In the more advanced stages the sheep spends considerable time biting, scratching or rubbing itself. It may even be noticed lying rubbing itself on the ground; finally, the wool is lost off large areas, leaving scab sores, on the margin of which acari should be sought for.

LESIONS PRODUCED.

The parasite pricks the skin; the punctures become inflamed, forming small moist red or pink spots; the serum which escapes on the skin dries, leaving a small crust for each bite; the total aggregate of the bites leading to the formation of large crusts or scabs.

The itchiness causes scratching, rubbing and biting, thereby adding to the initial inflammation and causing some hæmorrhages as the scabs are rubbed off and sores form.

The serum and scabs are favourable for the growth of bacteria, and septic infection with the formation of abscesses occurs. The skin reacts to the continued inflammation; it becomes thickened and cracked. When this stage is reached and a large portion of the body is affected, the sheep emaciates rapidly and if not treated death results.

Treatment.

There is no better method of destroying the scab parasites on the sheep than immersing the sheep in an *effective* dipping fluid and hand-dressing of the affected parts.

Experiments carried out at Onderstepoort proved that of the various dipping fluids used for the treatment of scab, some are effective, and particulars of such can be obtained from the Chief Veterinary Research Officer, Kabete, or from the publication referred to hereunder.

The following is extracted from the paper entitled, " The Effect of Various Dipping Fluids upon the Ovigerous Females of *Psoroptes communis*, var. *ovis*, and their Ova," by G. A. H. Bedford, F.E.S., Research Officer, Onderstepoort (published in the 13th and 14th Reports of the Director of Veterinary Education and Research, October, 1928, Part II, pages 861—879; Union of South Africa) :—

" The following rules should be adhered to :—

1. Properly mix the dipping fluid.

2. Before dipping shear, unless the sheep have very fine and loose wool; remove crusts on the bodies of infected sheep by hand-dressing, to allow the dipping fluid to reach the acari. This should be done with a brush steeped in a mixture of two parts of oil and one part of paraffin.

3. Ears of all sheep in the infected flock to be treated before dipping. It is not generally known that the sheep parasites can live in the ears of sheep, and that instances have occurred where sheep have been infected in the ears but not on either the head or body. The ear infection may be the cause of failure to eradicate scab if the ears of sheep are not hand-dressed.

Remove all crusts from ears, if present, with a pair of forceps, without causing bleeding, and then apply the above-mentioned mixture of oil and paraffin by means of a rag or cotton wool bound round the end of a stick, pointed like a pencil; dress ears at first as well as when giving a second dipping.

4. Keep the sheep's body completely immersed for a full two minutes; time with a watch or sand-glass, and put head under two or three times.

5. Give a second dipping nine to ten days after the first.

6. Do not return the flock to infected ground for sixteen days or longer after dipping in order to be on the safe side.

7. Only dipping fluids that protect sheep against scab for a number of days should be used. Some of the experiments have clearly shown that certain dips afford protection to sheep against scab for longer periods than others, and this is an important factor, especially if sheep are kept in infected places after dipping.

In attempting to eradicate scab there are other factors besides the quality of the various dipping fluids in general use, viz. :—

1. The personal element.

2. The length and quality of the wool of the sheep.

3. Length of time it takes an animal to dry after dipping.

4. Infection of the sheep.

Theoretically, one would expect short-woolled sheep to be more easily cured than long-woolled sheep, as it is easier for the dip to penetrate to the skin in the former; on the other hand, one would expect long-woolled sheep to be more easily cured because they take longer to dry. However, it is not only the length of the wool, but also the quality which counts. Long, fine, loose wool is an advantage over a thick and long fleece, as in the latter less dip reaches the skin and the acari; this probably explains why often certain dipping fluids have proved a success and other times a failure. The length of time it takes an animal to dry after dipping is of no importance if the animal is dipped in a fluid that will protect it against scab for a number of days, but if the dip is slow in killing power and does not protect the sheep against scab for more than a few hours after they have been dipped it may be the direct cause of a failure to cure.

Infection of the Sheep.—In the dipping trials carried out by Bedford in 1914 only sheep that were very badly infected with scab were used. Yet the various dips tested cured the animals of scab, with the exception of one or two, which proved useless. Had sheep possessing various

qualities of wool and in various degrees of infection been selected it is possible the result, at least in one or two instances, might have been different, because badly infected sheep fall off rapidly in condition, their wool becomes thin, and is frequently lost entirely on the worst infected parts. It is therefore an easy matter for the dip to gain access to the acari on these bare places, especially if the crusts are loose. On the other hand, with sheep that are only slightly affected, the wool may be sufficiently long and thick to protect the acari from the dipping fluid, if not entirely, to a sufficient extent to preserve their lives. Infection may start anywhere on the sheep where there is wool, but as a rule it commences on the body, and if not checked may spread to the head and even to the ears of the animals.

As it is only possible to immerse the heads of animals for a few minutes during the time they are in the dipping tank, it is quite likely that the head infection has in many instances been the cause of failures to cure scab.

We have found sheep infected with scab in their ears but not on either the head or body.

Recently we carried out a dipping test which proved that sheep that are infected with acari in the ears are not always cured of scab when given two dippings in the ordinary way. These observations prove how important the ear infection is, and how essential it is to hand-dress the ears of sheep when dipping for scab."

LAIKIPIA LUNG DISEASE.

This disease occurs throughout the settled areas of the Colony, and is most prevalent on the Laikipia Plateau, about Rumuruti, Nyeri and the Ngobit, while cases have been encountered on the Uasin Gishu Plateau and in the Rift Valley. Native stock in the reserves is also seriously affected, and undoubtedly is responsible for maintaining infection in certain districts. It is thus evident that squatter sheep may be responsible for introducing or maintaining the disease on farms when they are allowed to graze in the vicinity of settler sheep. The disease is specific for sheep. Cattle are very resistant to the inoculation of virulent material, while goats may only be infected by massive doses of culture or pneumonic tissue.

The disease causes a serious mortality in lambs every year and is most prevalent at or shortly after the lambing season. Cases are also noticed in older sheep, but these animals are

more resistant than lambs. It is not possible at present to say whether yearlings and other sheep were infected while very young, and therefore are chronic cases, or whether they were primarily affected when adults. Experimentally, adult sheep are very resistant and it would appear as if the majority of adult sheep were affected when lambs, and only manifest symptoms when for various reasons they relapse and show symptoms of acute pneumonia. Adult sheep suffering from chronic Laikipia disease may be regarded as " chronic lungers," and are a source of great danger to lambs, as they maintain infection in an insidious manner.

The disease has a seasonal occurrence, and is at its worst during the lambing months and during cold rainy weather, when the resistance of all animals is naturally reduced.

Cause.

Three organisms have been isolated from cases of the disease, viz., (a) a gram negative bacillus, and (b) a gram positive diplococcus. The former is the primary and specific cause of the disease, but the latter organism is constantly present in the lung lesions, and may be regarded as a secondary invader of some importance. Its exact significance, however, is not yet definitely understood. The causal organism has been isolated from diseased lungs, bronchial and pharyngeal glands, from the heart blood and from the joints of clinical cases of the disease. (c) The bacillus of necrosis is undoubtedly responsible for the necrotic lesions frequently found in the mouth and pharynx.

Period of Incubation.

Varies in experimental cases from one to thirty-one days, but is as a rule between seven and seventeen days. In new-born lambs on badly infected farms, the period of incubation is very short, for symptoms of pneumonia have been observed in ten-day-old lambs.

Symptoms.

May be acute or chronic. They vary considerably in severity, but in some cases may be unnoticed and the disease therefore not suspected or diagnosed during life.

(a) *Acute Laikipia Lung Disease.*—There are all the symptoms characteristic of an acute pneumonia, e.g. rapid, painful and blowing respirations, nasal discharge, very high fever, inappetence, great thirst, followed by great prostration and increasing weakness. Death is preceded by an aggravation of all these symptoms, and occurs during profound coma.

If mouth lesions are present there is marked salivation and tenderness of the mouth region, while in all cases there is more or less pronounced lachrymation, ptosis and photophobia. Coughing is not always noticed. When present, it is very soft and moist, and occurs in paroxysms. Direct examination of the lungs and chest wall is a matter of some difficulty in long-woolled sheep, and in any case requires considerable technical skill. It is not likely to be employed by stockowners in the diagnosis of this disease.

Mortality apparently varies between 25 per cent and 70 per cent, but an accurate estimate is not possible.

(b) *Chronic Laikipia Lung Disease.*—There may be no symptoms of this disease at all. The animal may only appear miserably thin and unthrifty, while it may cough occasionally.

The appearance presented by " chronic lungers " may strongly suggest parasitic infection, and obviously on badly infected farms both diseases may exist in sheep simultaneously.

Under certain conditions, e.g. after shearing, exposure to inclement weather, etc., chronic cases may relapse and develop all the classical symptoms of acute pneumonia. Many chronic cases, however, live for several years; they may appear in good health, except for a persistent poverty of condition, and the pneumonia unsuspected during life is only discovered at death. These chronic lungers are a source of infection on a farm, but they are very difficult to detect.

In a certain percentage of cases suffering from this type of pneumonia, joint lesions have been observed both in sheep under natural conditions and experimentally. One or more joints may be affected at the same time. The following joints have been found affected (in order of frequency), viz. carpus, elbow, tarsus, stifle, shoulder, hip and the fetlocks, etc. Clinically the animal is very lame and carries the affected limb. Examination shows the affected joint to be swollen, painful, warm and fluctuating. It may have ruptured and from it oozes a purulent dirty creamy pus, or it may remain unruptured and assume all the features of a " cold " or chronic arthritis.

Lameness in sheep is generally traceable to foot rot, but on farms where Laikipia lung disease occurs the possibility of joint lesion complicating a chronic pneumonia must be considered.
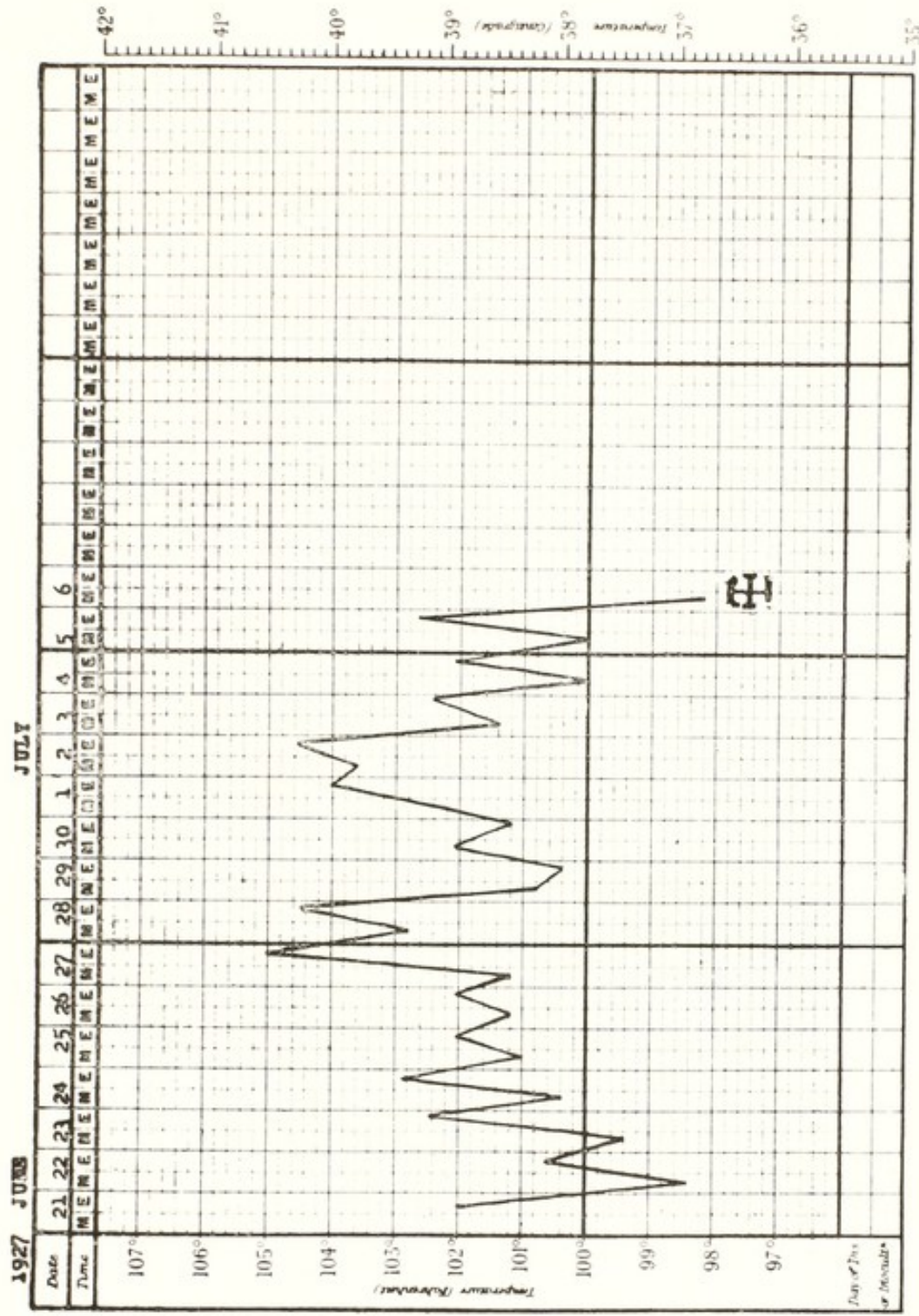
Disease :
LAIKIPIA LUNG
DISEASE.

Number : 2884

Description :—
— OVINE

Remarks :
NATURAL CASE
FROM LAIKIPIA.

LAIKIPIA LUNG DISEASE TEMPERATURE REACTION.

To face page 98

Post-mortem Lesions.

In one or both lungs there are found one or several abscesses varying in size from a pin-head to a tennis ball, full of very putrid creamy pus and surrounded by a zone of deeply congested or hepatised and œdematous lung tissue. Overlying the pulmonary abscesses is a deposit on the pleura which is attached to the pleura lining the ribs. In old cases this deposit becomes fibrous and forms a chronic pleurisy. Often the chest cavity contains a variable amount of serous fluid, but in some cases there is an empyema, i.e. the chest cavity is full of fœtid purulent fluid.

In acute cases the lungs are deeply congested and œdematous, while in chronic cases the lungs may appear more or less normal, with the pneumonia areas isolated by a pale-coloured callous tough zone. Frequently a lobe or part of a lobe may appear reddish purple in colour, solid, and full of small miliary abscesses.

In affected joints, pus is found free between the bones forming the joint, while the articular cartilages are deeply congested and often eroded. Pus may be found in the lymphatic glands of the throat, neck region, and near the bronchi. In any case, these glands are generally very much enlarged, juicy, and more or less congested.

Necrotic lesions may be found on the lips, roof of the mouth and tongue. On the latter organ they may be circular in outline, show a rough serrated border, and full of necrotic cheesy material.

Diagnosis.

A diagnosis of the acute form of this disease should present no difficulties. The age of the lambs, the contagious nature of the disease, the post-mortem lesions, etc., all allow of a positive diagnosis. In the chronic form, diagnosis is frequently very difficult, and only possible at a post-mortem. As mentioned earlier in this paper, the chronic form of the disease may be confused clinically with helminth infection, but no trouble should be experienced in distinguishing between the two diseases at autopsy.

Treatment and Prevention.

There is no medicinal treatment, and on farms where the disease exists every attention should be given to prophylaxis.

Sick animals should be isolated, kept under hygienic conditions, and fed nutritiously. The majority of acute cases in lambs will die, but those that recover should be watched and

noted as possible " lungers." Undoubtedly, chronic lungers are a source of maintaining infection on a farm, and every farmer should consider whether he should not make a clean sweep of these cases. This may not seem practical, but theoretically if lungers are destroyed then the reservoir of the disease is got rid of, and the incidence of the disease should materially decrease. At present there is no laboratory test which is of the slightest use in detecting these chronic cases, and there is no present prospect of any biological product being made to treat these cases.

Vaccination of all susceptible sheep and lambs should be annually carried out with the laboratory vaccine, which, although still in the experimental stage, is regarded by many farmers as distinctly useful in protecting lambs and reducing the mortality from the disease. As the method of vaccination and the dosage of the vaccine have not been finally worked out, it is not possible in this article to enter into fuller details regarding the use of Laikipia lung disease vaccine.

Finally, a warning may be given as to the necessity of rigidly keeping European sheep apart from native or squatter animals, as the latter are heavily infected with the disease, and are therefore a source of danger to the more susceptible sheep of European settlers.

CONTAGIOUS PLEURO-PNEUMONIA OF GOATS.

This is the most serious goat disease in this Colony, and is responsible for an immense loss of life every year. It attacks goats of all ages and of both sexes, while both native and imported breeds are equally susceptible. The disease appears to be most prevalent during the wet seasons, and is more or less quiescent during the rest of the year. Both under natural conditions and experimentally, the disease appears to be absolutely specific for goats.

Cause.

No cause has yet been found. Exhaustive research has failed to reveal any specific organism in the diseased lungs or thoracic fluids. Experimentally, however, the disease has been reproduced by actual contact, but all other methods of introducing diseased material from sick to healthy animals have repeatedly failed to set up symptoms.

Symptoms.

By contact, the period of incubation varies between seven and seventeen days, but it may be less under natural conditions when animals are crowded together and herded at nights under poor hygienic conditions.

The disease may run an acute, subacute or a chronic course. Most of the acute cases die, but if they survive after an illness lasting longer than ten days they may either completely recover or develop a chronic pneumonia. Complete clinical recovery does not confer any lasting immunity, as animals may break down to secondary attacks of the disease. These relapses are only non-fatal in a small percentage of cases. On the other hand, chronic cases may suddenly develop acute symptoms from which they either succumb or recover.

(a) *Symptoms of Acute Pneumonia.*—The symptoms are classical of acute respiratory disease, e.g. very high temperature, dry harsh coat, accelerated respirations, grunting or groaning, nasal discharge, generally thick and often tinged with blood, paroxysmal coughing, increasing weakness and disinclination to move. There may be a mild diarrhœa, but generally constipation is marked. Death is preceded by coma, convulsions and great weakness. Should the animal recover, there is a gradual decline in the fever and respiratory distress, but the temperature shows diurnal fluctuations, there is a continual coughing, nasal discharge, etc., while the animal remains in very poor condition for a considerable time.

(b) *Symptoms of Chronic Pneumonia.*—These may be so very obscure that the disease is only suspected by the persistent poor condition of the goat, by a very unsteady temperature, and by occasional coughing. Sometimes, however, the clinical symptoms are more pronounced, the coat is very harsh and dry, and there may be a troublesome diarrhœa, accompanied by great tenesmus—which, in one experimental case, led to prolapse of the rectum and anus.

Post-mortem Appearances.

Generally only one lung is affected at a time and the right appears to be more often the seat of lesions than the left. But in a few cases the pneumonia may be bilateral and hardly any normal lung tissue left.

(a) *In Acute Cases.*—There is free yellow fluid in the thorax, often in a softly coagulated state. Overlying the affected lung is a soft, moist, yellow gelatinous mass, which

contains numerous small cavities full of fluid. This mass lies between the pulmonary fissures and spreads over the peri-cardium. The costal pleura has a dirty reddish-brown appearance, and is much injected. On it are found flaky fibrinous deposits. The pneumonic areas are swollen, deep red-purple in colour, and very solid. Pieces of such areas sink rapidly in water, and, on section, are dryish, granular, break easily and show a mosaic of colours varying from grey through purple-pink to bright pink in colour. The bronchial glands may be the size of a walnut, and are very swollen and juicy. Other changes occasionally noticed are dilation of the heart, and a mild gastro-enteritis.

(b) *In Chronic Cases.*—There are more or less tough fibrous adhesions between the lungs and overlying chest wall, while the pleura covering the lungs and overlying is much thickened and pearly white in colour. The affected lungs show grey solid areas in which are patches of more or less normal lung tissue. In some cases the lungs show marbling, not unlike what is seen in bovine pleuro-pneumonia.

If the animal completely recovers there is more or less complete resolution, but a slight fibrosis or broncho-pneumonia and a persistent pleurisy may be found at post-mortem.

TREATMENT.

There is no specific medicinal treatment. Sick animals must be isolated, and all discharges destroyed. Careful nursing and plenty of fresh air and nutritious foods are far more valuable than any drugs.

All newly purchased goats should be kept under observation before being introduced into the main herds, and this precaution is particularly necessary for goats bought from natives. At present there is no serum or vaccine of the slightest value for either curative or prophylactic purposes.

D.—DISEASES OF DOGS.

PIROPLASMOSIS (*BABESIA CANIS*), TICK FEVER.

This disease usually affects puppies and newly imported dogs. Dogs born and reared in the Colony usually contract natural infection in early life and after recovery possess a resistance to the disease. The blood of recovered dogs harbours the parasites for a long time; instances have been recorded

where the blood was infective after one year and up to two and a half years, but from the writer's observations the blood of recovered animals sometimes fails to produce the disease.

CAUSE.

This is a blood parasite known as *Babesia canis*, which resembles in shape the redwater (*Babesia bigemina*) parasite of cattle. *B. canis* can be detected microscopically in blood-smears of affected dogs. It is a tick-transmitted disease. Several species of ticks have been proved to be carriers, but in this Colony the carriers are *Hæmaphysalis leachi* (the dog tick) and *Rhipicephalus sanguineus* (the European brown tick), particularly the former.

INCUBATION PERIOD.

After inoculation of infective blood the incubative period is about five to six days.

SYMPTOMS.

The first indication is a rise of temperature, which during the next two or three days may reach 104° F., or higher, followed by dullness, loss of appetite, shivering and somnolence. Anæmia soon sets in, and the gums and the membranes of the eye become very pale. After the disease has lasted for three to six weeks the anæmia gradually disappears and recovery takes place; in other instances, the disease assumes a chronic form, and recurrences of fever occur at intervals of about nine days with the reappearance of the parasite in the blood, and the animal eventually succumbs. In cases which run an acute course, death may occur in from three to ten days or thereabouts after the initial rise of temperature.

TREATMENT.

(a) *Curative*.—This is usually successful if carried out in the early stages of the disease. It comprises the inoculation under the skin of a dose of trypanblue. After inoculation with this drug normal health may be soon regained, but instances occur where despite treatment with trypanblue the disease runs a chronic course. In such cases re-inoculation with trypanblue has not been of assistance, and it would appear that the parasites acquire a tolerance to the dye preparation. Dogs in the convalescent stage should not be given strenuous exercise. Stovarsol or liquor arsenicalis, administered as a tonic, is of value when the animals show symptoms of anæmia.

(b) *Immunisation.*—This has been carried out at the Laboratory, Kabete, by inoculating susceptible dogs with blood of a recovered dog, which transmits the disease. The inoculated dog is kept under daily obesrvation, and as soon as the temperature rises and parasites are detected microscopically in its blood, the animal is treated with trypanblue.

Treatment is therefore carried out at the earliest possible moment after the commencement of the disease, and before it has had time to produce serious pathological changes in the organs. Nevertheless, the results obtained have not always been satisfactory, inasmuch as even with treatment in the initial stages the disease assumes a chronic course and despite careful nursing a percentage succumb.

In the case of valuable imported susceptible dogs, which it is usual to find contract the disease after arrival in the Colony, immunisation is of assistance if carried out under veterinary supervision. Particulars of immunisation can be obtained from the Chief Veterinary Research Officer, Kabete.

E.—DISEASES OF POULTRY.

KIKUYU FOWL DISEASE (FOWL TYPHOID).

Fowl typhoid is undoubtedly a great menace to successful poultry farming. It is widespread in this Colony, and from time to time occurs in epidemic form in new areas previously considered clean. It is probable that most of the Native Reserves in the country are infected, and the greatest care should therefore be exercised in purchasing poultry from natives. Poultry-keepers should not introduce birds to clean runs unless known to have come from a clean flock.

Cause.

The causal microbe of Kikuyu fowl disease belongs to the genus *Eberthella*, the type species of which is *E. typhi*, the causal organism of typhoid fever of man. In Kenya Colony the species usually found in outbreaks is *Eberthella sanguinaria*. Fowl typhoid is not transmissible to human beings. The organism can live in the soil for a long period, and infection usually occurs through the ingestion of infected soil, or of food contaminated with the excreta of infected fowls.

Birds Susceptible.

Fowls and turkeys are susceptible. Ducks are immune. It is the experience that fowls of this Colony are more susceptible to this disease than British fowls, the explanation possibly being that British birds have a resistance owing to the long existence of the disease amongst them.

Incubation Period.

This varies from four to fourteen days.

Symptoms.

The disease may assume an acute or subacute form.

(a) *Acute Form.*—In many cases the first indications of the disease is the more or less unaccountable death of one or more birds. As a rule, however, if the fowls are under close observation affected birds will be noticed to isolate themselves; their feathers become ruffled, their combs discoloured, and soon before death diarrhœa sets in. The temperature if recorded will register as high as 110° F., or over, for a day or two previous to death.

(b) *Subacute Form.*—In this form death does not take place for a number of days after the appearance of the first symptoms. The outstanding symptoms are : dullness, loss of appetite and diarrhœa, with a high temperature which suddenly drops to normal or below normal immediately before death.

Post-mortem Lesions.

The intestines as a rule show marked symptoms of inflammation. The liver is much swollen and in some cases studded throughout its whole surface with minute greyish points. The spleen is generally much enlarged. Blood extravasations may be seen on the heart and there may be some congestion of the other organs.

Treatment.

There is no known curative treatment for the disease, but considerable success has attended preventive inoculation.

Segregation of healthy birds from the sick ones should be carried out immediately the disease is detected, and all runs and articles which may have been contaminated by the droppings of the sick fowls should be thoroughly disinfected.

DIRECTIONS FOR THE USE OF KIKUYU FOWL DISEASE (FOWL TYPHOID) VACCINE.

The dose of this vaccine for fowls of all ages and breeds is one cubic centimetre, and for turkeys of all ages one-half cubic centimetre.

The vaccine should be injected under the loose skin of the chest wall, beneath the wing, by means of a hypodermic syringe. A syringe of five cubic centimetres capacity is most suitable, though one of another size may be used provided the dose can be correctly measured with it.

The syringe with its needle should be sterilized in boiling water before commencing the operation.

One inoculation only is necessary.

Sick birds should not be inoculated until all the apparently healthy ones are done.

Ducks are considered to be immune to the disease and need not be vaccinated.

As the natural immunity of young chickens appears to be unstable, all chicks of one month and over should be inoculated.

Laying is sometimes suspended following vaccination, but only for a short period as a rule.

The vaccine should be used within twenty-four hours after receipt, and the bottle should be shaken before collecting each syringe-full.

In employing this vaccine during an outbreak of Kikuyu fowl disease, it should be remembered that deaths from the naturally contracted disease must be expected to occur up to about one week following vaccination, as there is no immunity conferred by the vaccine until that time.

Immunity as the result of vaccination, as a rule, appears to last for one year at least, but instances have been recorded where the immunity was of less duration.

It is requested that fowls which are considered to have died as a result of the vaccination should be forwarded here for examination and report.

Every care is taken in the preparation of this vaccine, but no guarantee is given as to its safety and efficacy.

FOWL DIPHTHERIA (FOWL POX).

Fowl pox is of fairly common occurrence. The lesions occur either in the skin or on the mucous membranes; in the latter case, chiefly in the mouth and throat. Sometimes both forms occur in the same bird. The skin form is sometimes described as fowl pox and the nose and throat form as fowl diphtheria. Until recently fowl pox was considered to be a separate disease from fowl diphtheria. More recent research, however, showed that they are caused by the same organism, and are simply different forms of the same disease. The disease is highly contagious; the virus is active in the dried scabs and mouth and other lesions, has some resistance against external influences, and runs remain infective for some time.

Poultry-owners whose flocks and runs are clean should avoid the risk of infecting these by birds whose history is not known; even after apparent recovery the virus exists in the blood for several weeks and birds apparently healthy may be carriers of the disease.

According to recent literature fowl pox is transmitted mechanically by winged insects (mosquitoes) after feeding on the lesions of infected birds.

CAUSE.

Fowl diphtheria (fowl pox) is a filtrable virus, which is present in the epithelial masses and diphtheritic membranes.

BIRDS SUSCEPTIBLE.

The disease occurs in domestic fowls, turkeys, pheasants, pigeons, the peacock and sometimes in water-fowls.

INCUBATIVE PERIOD.

After natural infection, symptoms of the disease usually appear in six to twelve days.

PATHOGENICITY.

After scarification of the comb or wattles with infected material a reaction appears at the site in about five to six days; this manifests itself as a small nodule. After three or four more days, hæmorrhages appear, the blood dries, and thick scabs form. When scarified on the mucous membrane of the mouth a croupous diphtheritic inflammation, or a local reaction in the form of a light yellow membrane appears.

SYMPTOMS.

The clinical symptoms depend on whether the skin or the mucous membranes or both are affected.

In the skin form, the head is usually first affected, the comb, around eyes, ears, wattles being involved. There first appears a bran-like grey deposit, soon followed by small nodules, at first grey-red but which later are greyish-yellow in colour. These nodules are composed of the horny or fatty degenerated epithelial cells. They are at first separate, but subsequently may coalesce to form thick dry scabs, the eyelids become thickened, and it is usual to find the eyes completely closed. The comb and wattles are much thickened and deformed. The conjunctival sac may be distended with a caseous and purulent secretion, and there may be a purulent ophthalmia. Nodules similar to those on the head may develop particularly on non-feathered parts of the body and legs.

The other form usually begins with a local affection of the mucous membranes, usually of the mouth. There may appear small oval or spherical yellowish-white spots which extend and form membranes, or the mucous membrane becomes dark-red in colour, soon followed by a greyish deposit on its surface, which gradually becomes thicker and forms deposits at first grey or yellowish, later dark-brown. The membranes are usually adherent to the subjacent tissue, or the mucous membrane is covered with cheesy, easily removed masses of exudate.

The croupous diphtheritic membranes develop chiefly on the mucous membrane of the mouth, especially on the tongue, corners of mouth and cheeks, on the wall of the pharynx and near the larynx, sometimes the larynx, windpipe and air passages of the lungs; the œsophagus and crop may become affected.

Respiration and swallowing become difficult, and the bird ceases to eat and loses condition. When the nostrils are affected there is usually at first a serous discharge which soon becomes muco-purulent, and which dries on the orifices of the nostrils; from the nostrils the process extends in one or both sides of the cella infra-orbitalis, which becomes filled with exudate, and bulges under the eye. The birds breathe deeply and shake their heads frequently when the nostrils are affected and closed. When the eyes are involved there is at first an acute catarrh, the lids become swollen and under the lids a muco-purulent exudate accumulates. The exudate, if not removed, dries and forms thick yellow-white masses, which cause the lids to protrude and force the eye back. In other cases, a diphtheritic membrane develops on the conjunctiva; the inflammation may extend to the cornea, which becomes ulcerated.

When the intestines are affected there is profuse diarrhœa, with fluid fæces, sometimes mixed with pus or blood. The general condition of the patient is at first not affected, but later it changes markedly; the affected birds become emaciated and death results.

In some outbreaks both forms occur in the same bird (mixed infection), although not necessarily at the same time. In most cases of mixed infection the skin of the head is first attacked and the inflammation process spreads from the corners of the mouth to the mucous membrane of the mouth.

Course and Prognosis.

In the skin form the percentage of recoveries is greater than in the diphtheritic form. In the former, in cases with a favourable course, recovery usually occurs in from three to five weeks. In the latter form, the larynx and bronchi and intestines are often involved, and the mortality may reach 50 per cent or thereabouts, especially in young birds.

The diphtheritic form lasts usually from two to three weeks; sometimes one to two months or longer.

Diagnosis.

Avian diphtheria may be confused with contagious catarrh of the nostrils, but this affection is confined to the nasal cavity and there is no false membrane formation, and the symptoms are not so severe as diphtheria.

A decision as to whether the diphtheritic affection of the mucous membrane is caused by a filtrable virus can be determined by filtration tests; when a simultaneous or subsequent affection of the skin and mucous membrane exists, the indications are that the filtrable virus is the cause of the diphtheria.

Post-mortem Appearances.

The lesions may be confined to the skin or to the mouth and nose, but in most cases the skin as well as the mucous membranes are affected. In addition to the epithelial nodules of the skin, croupous diphtheritic deposits are found in the mouth, throat, and sometimes in the nose, larynx, windpipe, and air passages, as well as in the intestines. The intestines show inflammation and small hæmorrhages; shallow ulcers may occur on the intestinal mucosa, or firm dry nodules may be seen in the cæca.

In acute cases the spleen is enlarged, there may be fine yellow spots in the liver, œdema of the lungs, hæmorrhages and a fibrinous deposit on the serosa, and a serous exudate in some joints.

TREATMENT.

If the disease is confined to the skin, treatment is often effective; the affection of the mucous membrane may sometimes be arrested in its early stage. The skin nodules are softened with soda solution or oil and removed. The deposits on the mucous membrane are removed with a pair of forceps and the exposed surface is painted twice daily with either of the following: 1 per cent silver nitrate solution, 1 per cent corrosive sublimate, lactic acid, 2 per cent lysol, tincture of iodine. The eye, if affected, should be washed daily with warm water, and the eyes subsequently treated with 2 per cent boric acid solution or creolin. Tumours below the eye could be opened and thoroughly cleansed after evacuation of the contents. When catarrh of the intestines is present, sulphate of iron 1 per cent solution in drinking water may be given, but usually treatment of this condition is not hopeful. If proper treatment is not possible, and the birds are of little value, the disease should be suppressed by destroying the diseased birds and in-contacts, and by carrying out thorough disinfection of the coops and runs.

Prevention consists in isolation of the sick and removal of sick birds, cleaning and disinfection of the coops and runs, and inspection of the mouths of newly bought birds from time to time and isolation of any of these which show suspicious skin or mouth lesions.

PREVENTIVE INOCULATION.

A vaccine is now obtainable from the Laboratory for the immunisation of birds. Vaccination should be carried out before the disease appears in the flock.

F.—DISEASES OF SWINE.

SWINE FEVER.

Swine fever in this country is of a much more virulent kind than the type which is met with in Europe. Fortunately, it is very rare in its incidence, but when it does occur amongst a herd of pigs it is usually responsible for a high percentage of mortality.

CAUSE.

The disease is caused by an ultra-visible virus which gains entrance to the animal's system by the ingestion of contaminated food materials. The disease, it is said, cannot be contracted in any other way, except by artificial inoculation or by the virus gaining direct entrance to the body through sores in the skin.

The virus is present in the blood and organs, and in the body secretions and excretions, urine and fæces. It is readily killed on exposure to the sun, but if protected from this destroying agent it may remain active for some time.

When collected in O.C.G. mixture, the blood has been found virulent when stored at room temperatures for varying periods up till approximately three years.

It has been shown that wart hogs contract the disease, and although they show little or no symptoms they are able to act as carriers of the infection, and it is probable that in many of the outbreaks which occur these animals are responsible for the introduction of the infection. The virus may also be carried from infected styes and farms to clean areas by humans or by the transport of meat from the diseased carcasses. The spread of the disease amongst animals closely housed together is very rapid.

The reservoir and possibility of transmission by an intermediate host should be investigated.

INCUBATION PERIOD.

When infection has been contracted naturally, this period is approximately seven days. After inoculation of virulent blood the incubation period averages three to four days; sometimes less.

SYMPTOMS.

There is usually a sharp rise of temperature, reaching maybe 106° F., and the temperature remains elevated throughout the course of the disease, but usually drops suddenly before death; dullness and loss of appetite soon show themselves; the animal hides itself under the bedding, the breathing becomes accelerated and jerky, the beast will be seen with arched back and dejected appearance, and usually lying down; there may be a swaying movement of the hind part of the body and muscular tremors.

Sometimes, unless the animals are under very close observation, the first indication of an outbreak is the discovery of one or two dead pigs, while a number of others are obviously sick.

Death usually occurs in from about four to five days after the commencement of the temperature reaction.

POST-MORTEM LESIONS.

Unlike European swine fever, marked bowel lesions are not always present in the East African type of the disease. The lesions usually encountered are : An exceptionally large spleen, a claret-coloured inflammation of the stomach, œdema of the lungs, hæmorrhages on the outside wall of the heart and lining of the heart cavities, and a spotted, turkey-egg-like appearance of the kidneys. The outside of the intestinal wall often shows small pin-point hæmorrhages, and it is usual to find bowel lesions in the form of blood extravasations, in which case the contents of the large intestines are mixed with blood. The mesenteric and body lymph glands are invariably hæmorrhagic.

TREATMENT.

There is no known medicinal agent or preparation which will effect a cure. Segregation of the healthy from the diseased pigs and thorough disinfection of infected styes and utensils and slaughter of affected pigs and burning of carcasses should be carried out.

The early morning temperature of all pigs should be taken and those running a normal temperature should be separated in a clean stye away from the infected styes. The temperature of the pigs which are removed to the clean stye should be taken for a further ten days, which covers the average incubation period from natural infection. Should any show a high temperature during this period they should be *immediately* removed from the styes and destroyed, and the temperatures of the remaining pigs taken daily for ten days after the last case. If the animals which are removed to the clean styes run a normal temperature for ten days after removal, they may be considered clean.

The attendants of the pigs which are removed to the clean styes should not be allowed access to infected styes, and in taking the temperatures the thermometer should be disinfected after each pig's temperature has been taken in order to avoid transmission of the disease from one pig to another through the medium of the thermometer.
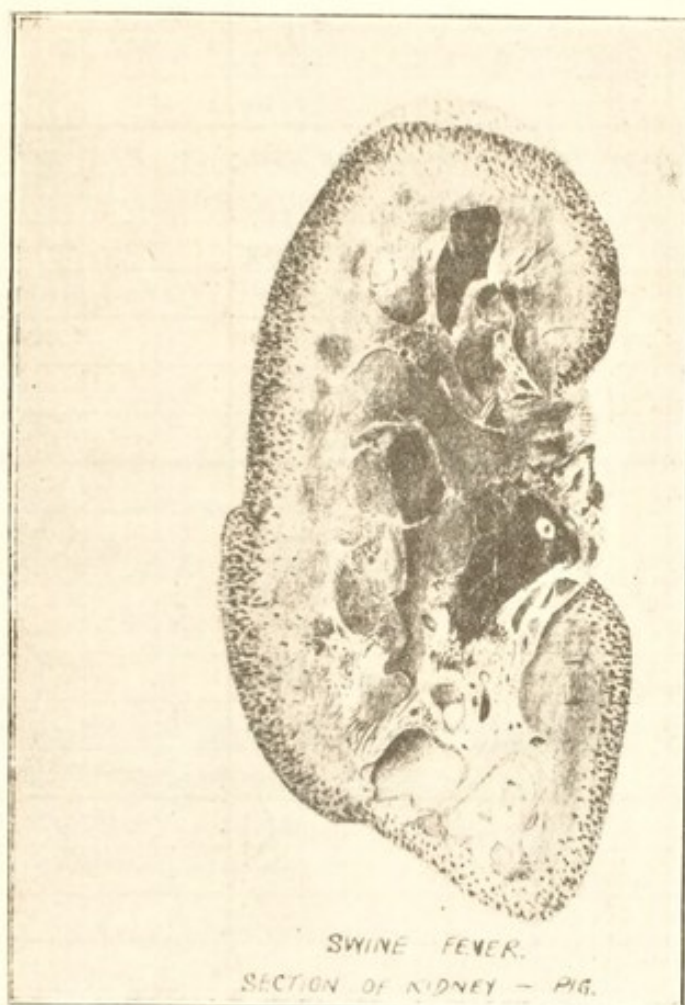
SWINE FEVER.
SECTION OF KIDNEY — PIG.

SWINE FEVER KIDNEY—PIG.
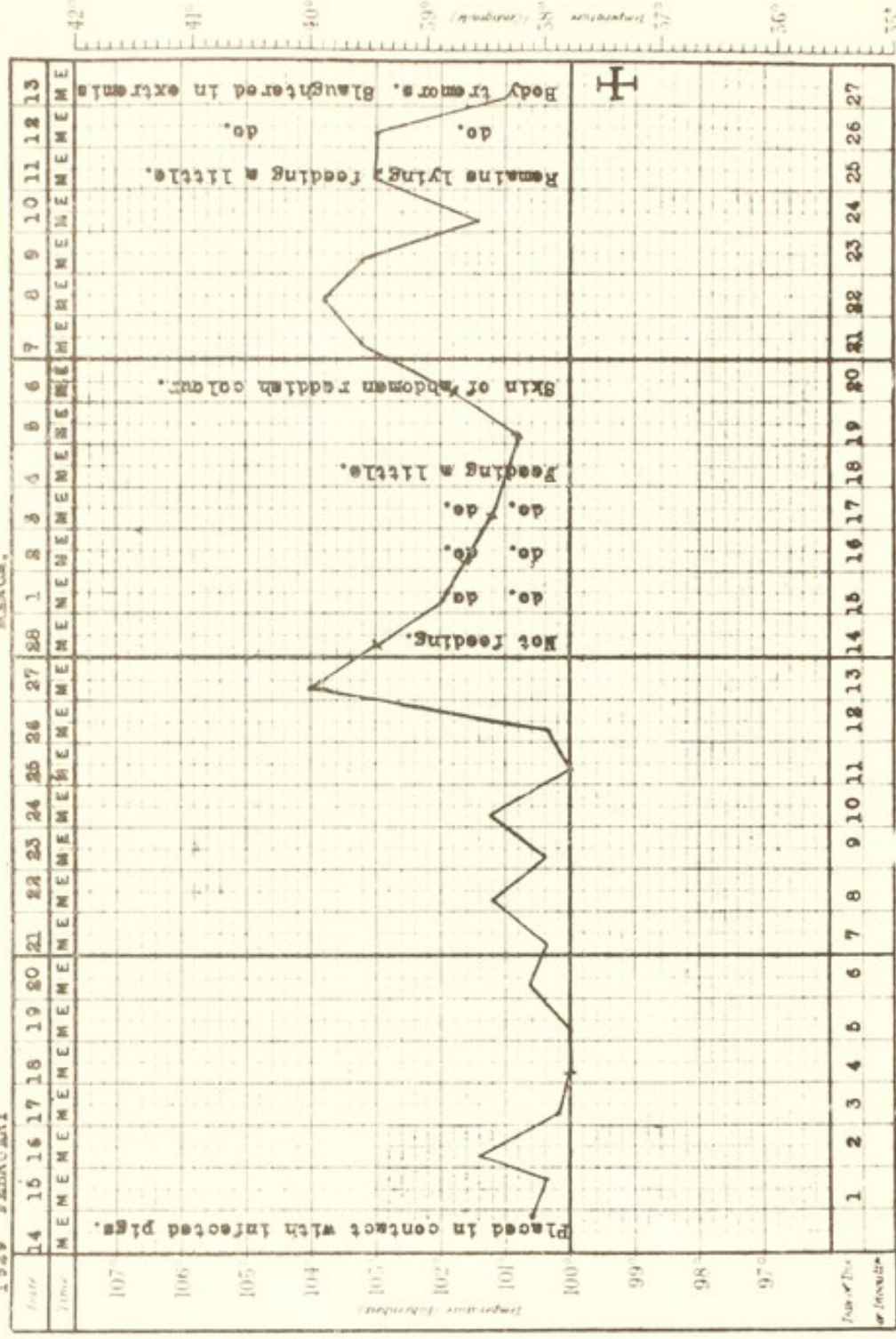
SWINE FEVER TEMPERATURE REACTION—NATURAL INFECTION.

IMMUNISATION.

The experiments now in progress are encouraging, and endeavours are being made to introduce a method of immunisation.

CONTAGIOUS BRONCHO-PNEUMONIA OF SWINE.

This disease is most prevalent in sucking pigs and is responsible for a considerable mortality from time to time. The disease, however, cannot be regarded as being very prevalent in this Colony.

CAUSE.

The cause is quite unknown, but as the disease is believed to be a variant form of swine plague or fever, it is probably primarily due to an ultra-visible virus.

Bacteriologically, however, very little is known about this disease.

SYMPTOMS.

The symptoms are those of marked respiratory trouble, as evinced by continuous coughing, rapid and painful respirations, fever, loss of appetite, and nasal discharge. Exhaustion rapidly appears and is followed by death.

Mortality is very high in sucking pigs, varying from 50 per cent to 80 per cent of affected animals. In older animals, however, it is much less, and averages about 10 per cent.

POST-MORTEM LESIONS.

Parts of one or both lungs are consolidated, red to purple in colour, and may contain purulent foci of various sizes. Very frequently the pneumonia is complicated by ulceration of the stomach and intestines.

TREATMENT.

There is no medicinal treatment. Energetic measures should be enforced to arrest spread of the disease, all premises occupied by sick animals should be thoroughly disinfected, and no new purchases should be introduced into a herd until they have been isolated for fourteen days or so. Sick pigs should be kept rigidly isolated, but it is probably most desirable to kill off ailing animals.

BACILLARY NECROSIS OF SWINE.

As in cattle, this disease is usually confined to sucking pigs. The common sites for the infection to locate itself are the gums, snout, and face, and, through extension of the disease, the stomach, intestines, lungs and liver may become involved.

The same curative and preventive method recommended for calves should be employed.

WORM PARASITES OF THE DOMESTICATED ANIMALS.

Departmental Bulletin No. 26/1928 which deals with the important parasitic worms of sheep in Kenya Colony may be obtained from the Veterinary Research Laboratory, P.O. Kabete.

The commoner parasites which occur in the other domesticated animals, viz. the horse, cattle, pig and dog, are briefly referred to hereunder.

Stockowners are recommended to collect and forward to the Veterinary Research Laboratory any worms they may find in their animals and in the event of such being identified as being of pathogenic importance, to obtain particulars as to the life history and measures for curative treatment and prevention.

The worm parasites of the horse, cattle, pig and dog are divided into three groups, viz. (1) the flukes; (2) the tapeworms; (3) the roundworms.

PARASITES OF THE HORSE.

(A) *The Flukes.*—These are of little or no economic importance. In the large intestines a small saucer-shaped parasite about half an inch broad, light pink in colour with a knob at one end is sometimes to be found. This is known as *Gastrodiscus ægypticus.*

(B) *Tapeworms.*—At least three different species of adult tapeworms are known. They exist either in the large or small intestine. Their life history is not known. If occurring in large numbers they may somewhat affect the animal's health.

(C) *Roundworms.*—A number of varieties occur some of which, particularly in young animals, cause digestive disturbances and unthriftiness.

(1) *Habronema.*

Three species are known, viz. *Habronema megastoma*, *H. microstoma*, and *H. musca*. *H. megastoma* burrows into the stomach wall and causes a tumour varying in size up to a hen's egg in which the parasites are to be found. The other two species burrow superficially into the wall of the stomach.

Life History.—The eggs which contain the larvæ are swallowed by the house- or other fly larvæ which occur in the manure. When the latter develop into flies the *Habronema* larvæ find their way to the mouth parts of the fly and when the latter bite on a horse the larvæ are set free. Should they find their way to the mouth of the horse they are swallowed and develop in the stomach.

Prevention.—This consists in the destruction of the house-fly larvæ, by packing the manure in heaps and preventing the escape of the larvæ by making a channel containing liquid round the heap to prevent any larvæ escaping. The larvæ which develop in the manure are destroyed by the heat generated in the manure. This method is known as Baber's Fly Trap.

Treatment.—Fasting the horse for a day and giving two to four ounces of oil of turpentine in two pints of raw linseed oil is of assistance.

(2) *Ascaris Megalocephala.*

This worm is found in the small intestines. The body is yellowish white; the female measures from about six inches to a foot and about as thick as a goose's quill. In the male the tail is straight; in the female it is in the form of a hook.

Life History.—This is a direct one, that is to say there is no intermediate host. The eggs after being voided develop to a certain stage and when taken in by the host reach the bowels and then penetrate the blood vessels and pass to the liver and lungs. They then ascend, via the wind-pipe, to the mouth from where they pass again to the intestines, where they undergo complete development.

Effects.—In young horses in particular there may be purging or colic and unthriftiness.

Treatment.—Fast for twenty-hours hours, then give two to four ounces of turpentine (and one ounce of oleoresin of male-fern) in a pint of raw linseed oil followed in twelve hours by another one to two points of oil to expel the dead worms.

The above dose is for a full-grown horse. The following powder may be used alternatively, morning and evening for a week or so: Arsenic, 3 grains; ferrous sulphate, 1 dram; antimony tartrate, 1 drachm; gentian, 4 drachms.

Prevention.—The ova which are very resistant to external influences are spread in the fæces and infect the grazing and drinking water through which re-infection occurs. Worms which are voided by infected horses should be burned to prevent the ova developing.

(3) *Strongyles.*

There are about forty different species of these; they inhabit the large intestines and a number are usually found in every horse. They are divided into large and small *strongyles.* The large comprise at least three species, and the small many species.

Life History.—In the small variety the eggs hatch outside the body and the larvæ, when development is complete, crawl up the blades of grass and are swallowed by the horse. They pass into the large intestines, where they grow into adults.

The large variety do not remain in the intestines. They migrate; one species gets into the body wall and develops there and then find its way back to the large intestines, while the other develops in the walls of the large intestines where it forms small dark-red nodules in which the worms can often be found. Later they pass through the wall of the intestines to the lumen of the bowel. Their life history is not quite clear.

Effects.—Except when heavy infestation by the adult worms in the intestines occurs, they are not of much pathogenic importance. The worms probably produce toxins which are injurious to the host. Symptoms are unthriftiness, the larvæ during migration may enter a blood vessel and produce thickening and clotting of the blood, and thrombus formation; part of the thrombus may break away and block a small branch of an intestinal vessel which is likely to cause serious disturbance and death.

Treatment.—After fasting for twenty-four to thirty-six hours give two to four ounces of turpentine in two parts of linseed oil, or four or five drachms of oil of chenopodium in two parts of raw linseed oil. The latter treatment is more expensive but more effective.

Prevention.—Provide clean water and keep horse off infected grazing.

(4) *Oxyuris Equi.*

This worm lives in the large intestines. The females are one to five inches long and are either white or greyish blue or brown in colour. About one-third of the body is thick, the remaining two-thirds forms a long thin tail.

Life History.—The eggs are deposited by the female around the skin of the anus and base of the tail and after a few days drop off. If swallowed by the horse, the larvæ hatch in the stomach and pass to the large intestines where they develop into the adult.

Effects.—The worms cause a constant irritation of the anus which causes the horse to rub its tail, resulting in the hair falling off at the root of the tail.

Treatment.—Give the horse an enema of warm soapy water and after this is evacuated give an enema of common salt or lime water or one to two quarts of quassia made by soaking quassia chips—2 drachms to a pint of cold water for half an hour. Remove the young worms in the intestines by treating with the powder as recommended above for *strongyles.* Mercurial ointment is also sometimes applied around the anus to destroy the eggs and stop itching.

Considerable care should be exercised in dosing horses owing to the risk of some of the fluid entering the wind-pipe and lungs and setting up pneumonia.

It is recommended that dosing of equines should only be carried out by a Veterinary Officer.

PARASITES OF CATTLE.

(A) *Flukes.*

(1) *The Liver Fluke.*

Fasciola gigantica occurs in cattle as well as in sheep; the life history, symptoms, lesions produced, preventive measures, etc., are dealt with in Bulletin 26/1928.

(2) *Paramphostomes.*

These are found in the first and second stomach of ruminants. They are about the size of a pea, pear-shaped, light red in colour. Occurring in the stomach they are considered harmless, but instances have been recorded when they have been found in the small intestines, and which are said to have been responsible for diarrhœa, loss of condition and some mortality.

(B) *Tapeworms.*

(1) *Adult Tapeworms.*

Several species of these are found in cattle. Their life history is unknown. Segments of the tapeworm are usually to be found in the fæces of infected cattle.

Treatment.—Various remedies are used. Extract of male-fern is considered most efficacious. The laboratory wireworm remedy has been used with fair success for the treatment of tapeworms in calves.

(2) *Tapeworm Larvæ. Cysticercus bovis (Beef Measles).*

This is the most important larva of cattle. Beef measles are the larval form of *Tænia saginata*, a tapeworm which occurs in the small intestines of man.

Life History.—The segments voided in the fæces of infected humans contain the eggs. When these are swallowed by cattle they hatch into larvæ in the stomach and intestines and then penetrate blood vessels and are carried to various parts of the body and eventually encyst in the muscles where they appear as small bladders about the size of a pea, bluish-white in colour with an opaque spot, which represents the head, on the inner wall. They require about eighteen weeks to reach the infective stage and if then swallowed by humans they develop into the adult tapeworm. Humans who harbour the adult tapeworm may get infected with the eggs, in which case the eggs develop into cysts, which are sometimes found in the brain and elsewhere with serious results.

Treatment.—There is no known medicinal agent which will effect the destruction of the cysts in the muscles of infected living cattle. Infection of cattle can be prevented by destroying the tapeworm in humans by treatment with extract of male-fern. Infection in humans can be prevented by eating only well-cooked meat, by a proper system of meat inspection and by the destrutcion of carcasses of infected cattle. Natives are commonly infected with tapeworm and are chiefly responsible for the spread of infection. Other preventive measures consist in treating infected natives with extract of male-fern and erecting latrines for natives and suitable disposal of the fæces.

(3) *Echinococcus (Hydatid Cysts).*

This tapeworm larva is found in cattle as well as in other mammals and in humans. The cysts represent the larval form of *Tænia echinococcus*—a tapeworm of the dog.

The cysts which vary in size up to about that of a man's fist are full of a clear watery-like fluid, and contain on their inner surface a number of tapeworm heads, and are found in various parts of the body but usually in the lungs and liver.

Life History.—The segments of the mature tapeworms which contain the ova are voided with the fæces of the infected dogs. When swallowed by humans and other animals the eggs develop into cysts, and when the dog eats the organs containing the cysts, the tapeworm heads contained in the cyst develop into tapeworms in the dog's intestines.

The cysts do no harm to cattle, but they may cause pathological conditions in humans by pressure on certain organs and blood vessels, and if the cysts in the body rupture, the heads contained in the cysts scatter and may develop in the brain and elsewhere with fatal results.

Prevention consists in preventing dogs eating the cysts and treating infected dogs by dosing with arecoline hydrobromide one-eighth to half a grain in one ounce of water after starving for twenty-four hours. Dogs after being dosed should be kept locked up until the drug has expelled the tapeworms, the latter should then be destroyed by burning.

(4) *Coenurus cerebralis* is the cystic form of *Tænia coenurus*, one of the dog tapeworms. It occurs less frequently in cattle than in sheep.

The life history, treatment and prevention are similar to that of *Echinococcus*.

(C) *Roundworm.*

Those likely to be met with are :—

(1) The *eyeworm* of cattle which is found beneath the eyelids or in the corners of the eye. It is a small whitish worm about half to three-quarters of an inch in length. It is probably transmitted from animal to animal by a winged insect; it causes an inflammation of the eye.

The worms can be removed by the fingers or a pair of forceps.

(2) *Wireworm (Hæmonchus contortus).*

This is the same parasite as the wireworm of sheep and is fully dealt with in Bulletin 26/1928.

(3) *Hookworm (Bunostromum phlebotomum).*

Similar in appearance and size to the sheep hookworm. The sheep hookworm does not infect cattle and vice versa. It is not of much importance unless occurring in large numbers.

(4) *Nodular Worm (Oesophangastomum radiatum).*

This worm occurs chiefly in calves in the large intestines. It is not the same species as the nodular worm of sheep. It is about one inch long, whitish in colour, and the anterior end is hook-shaped. It is of little importance compared to the sheep nodular worm.

The life history, treatment and prevention is similar to that of the latter and is discussed in Bulletin 26/1928.

(5) *Calf Ascaris (Ascaris vitulorum).*

This worm is yellowish-white in colour and about six to ten inches long.

Its life history is probably similar to the other ascaris.

If occurring in large numbers they may cause losses in calves.

Treatment.—Two to four drachms of turpentine in a pint of raw linseed oil may be of assistance.

(6) *Whipworm (Trichuris ovis).*

Occurs in the large intestines. It is about half an inch long. It has a direct life history and is of little pathogenic importance.

(7) *Lungworm (Dicryocalus viviparus).*

This worm is found in the air passages of the lungs; it is one and a half to three inches long and white in colour. The eggs contain completely developed larvæ.

Life History.—The eggs may hatch in the lungs, the larvæ are coughed up and are either expelled from the nose or mouth or are swallowed and pass through the intestinal tract, and after further development outside the body the larvæ are taken in with the grass and water. After arrival in the stomach and intestines they pass through the walls of the blood vessels and reach the lungs.

The parasites cause an irritation of the lungs and a verminous pneumonia resulting in an impoverished condition of the host.

Treatment consists in injecting into the wind-pipe by means of a hypodermic syringe medicinal agents. The following is said to be of assistance :—

Turpentine, 2 drachms; carbolic acid, 20 drops; chloroform, 1½ drachms; injected once daily for three successive days.

Affected animals should be well fed.

Prevention.—The larvæ does not survive on dry ground and precautions should be taken to keep the cattle from wet and marshy parts of the grazing.

Various species of the genus *Trichostrongylus, Ostertagia* and *Cooperia* respectively have been recorded as occurring in cattle in this Colony some of which may be responsible for losses particularly in calves.

PARASITES OF SWINE.

(A) *Flukes.*

Several varieties of flukes are known to occur but they are not of much importance.

(B) *Tapeworms.*

(1) *Adult.*

The pig does not harbour any adult tapeworms.

(2) *Larval. Cysticercus cellulosæ.* (Measles).

This is the cystic form of *Tænia solium* of man. The cysts occur in the pig in various muscles, e.g. tongue, neck, forearm, etc. The cysts sometimes occur in humans.

Effects.—The parasites are extremely dangerous, inasmuch as human beings become infected through eating measly pork.

Life History.—The segments which contain the ova are voided in the fæces of infected humans, and pigs become infected through swallowing the ova with the infected food and water. Treatment and prevention is similar to that of beef measles.

(C) *Roundworms.*

(1) *Stomach Worms. Arduenna strongylina and Physocephalus sexalatus.*

These are fairly comon in pigs. They are about three-quarters of an inch long, and occur under the mucous of the stomach and may be responsible for digestive disturbances.

Life History.—The eggs are pased by the fæces and are swallowed by dung beetles in which they develop and the pigs become infected by eating the dung beetles.

Treatment, is unsatisfactory owing to the burrowing habits of the worms and thus the difficulty of their being acted on by drugs.

Prevention consists in destroying the manure so as to avoid breeding of beetles in it.

(2) *Ascaris.* (*Ascaris lumbricoides*).

This is a large worm five to eight inches long, cream colour; it is found in the small intestines.

Life History.—The eggs are passed out with the fæces and in two to six weeks become infective. After entering the stomach with the infected food or water, the ova hatch in the intestine and the larvæ gets into a blood vessel and pass by the blood stream through the liver to the lungs. They then crawl up the windpipe or are coughed up and reach the mouth and are swallowed and on reaching the intestines develop into the adult.

The period of migration through the body occupies about ten days. The eggs voided by infected pigs are very resistant to external influences. They are not killed by most chemicals.

In young pigs in particular *Ascaris* infection is responsible for stunted growth and unthriftiness, and the migration of the larvæ through the lungs may be responsible for a chronic pneumonia. It is largely on account of worm infection that many young pigs fail to grow properly. The loss from *Ascaris* infection in young pigs is sometimes very serious and makes pig farming unprofitable.

Treatment.—Starve for twenty-four hours if the pig is in a suitable condition to survive the starving and dose with oil of chenopodium at the rate of one drachm for every 100 lb. body weight in 2 oz. of castor oil and prevent re-infection by keeping the pigs in non-infected styes. The administration of worm remedies or other medicinal agents in *capsules* is not recommended as the capsules are likely to get down the wind-pipe and cause choking.

Prevention.—The following method known as the " McLean County System " was introduced in America to prevent infection in young pigs. Essentially it consists in handling young pigs from birth until they are several months old so as to avoid or reduce to a minimum the chances of

infection with worms; in other words to keep young pigs entirely away from old hog lots, or places that have been exposed to fæcal contamination.

Farrowing Pens.—Before farrowing, the pens are thoroughly cleansed, all litter is removed and the concrete or wooden floors and sides of the pens are scrubbed with boiling water and lye.

After freeing the sows of infection by dosing, they are placed in the clean pens a few days before farrowing but not before the mud and dirt that is usually present on their skins has been removed. The udder particularly should be well washed with soap and water; the object of this preliminary treatment is to clean the skin and udder of worm eggs, so that the new-born pigs will not swallow the eggs which may be present on the skin and udder. After farrowing, the sow and pigs are not allowed out of the farrowing pen until they are taken to pasture; the sow and her litter in a few days to two weeks after farrowing are moved to pasture in a double crate or sledge, one compartment for the sow and one for the pigs.

Pastures.—The pasture should not be a permanent pasture which has been used by other pigs but one that has been under cultivation. Shelter houses for each sow and her litter are provided in the pasture and water supplied by piping or tanks. No other pigs should be allowed access to the pasture, nor should the pigs be allowed to wander off the pasture.

They should be kept from infected places until they are at least four months old. By this time they have acquired a resistance against worm infection but they should, nevertheless, not be brought back to insanitary conditions, or to heavily-infected styes.

(3) *Lungworm.* (*Metastrongylus elongatus*).

This worm is found in the air passages of the lungs; it is white in colour and one to two inches long.

Pigs become infected by swallowing the infected larvæ. Infected pigs should, if possible, be kept on dry pastures, well fed and provided with shelter and kept under good sanitary conditions.

(4) *A Nodular Worm.*

A nodular worm which is not the same as found in cattle and sheep and a whipworm (*Trichuris*) may sometimes be found in the intestines, but they usually do not produce any serious disturbances of health, unless present in large numbers.

Parasites of the Dog.

(A) *Tapeworms.*

(1) *Tænia echinococcus.*

This is a small tapeworm about a quarter of an inch long which occurs in the small intestines.

Life History—The ova when swallowed develop in the stomach of almost all mammals, including man, and the larvæ burrow through the walls of the intestines and are conveyed by the blood to various parts of the body—liver, spleen, kidneys, heart, brain, etc.—where they develop into cysts, on the inner wall of which a number of tapeworm heads develop; in some instances the cysts rupture in the infected animal and these can again develop into cysts. The cysts may, by their pressure on organs and vital parts, cause serious results.

Treatment.—Starve for twenty-four hours and then give arecoline hydrobromide, $\frac{1}{8}$ gr. to $\frac{1}{2}$ gr. in $\frac{1}{2}$ oz. to 1 oz. of water.

There is no medicinal agent which destroys the cysts in man or other mammals, but their removal surgically is sometimes resorted to in humans.

(2) *The Gid Tapeworm (Multiceps multiceps).*

Is found in the dog and jackal. The cystic form develops in the brain of sheep, goats and cattle. Preventive measures consist in treating the dog with arecoline hydrobromide.

(3 *The Cucumber Seed Tapeworm.*

Is found in most dogs and in the jackal and cat. It is so called because the segments resemble cucumber seeds.

Life History.—The eggs voided by infected animals develop in the dog's fleas and lice, in which they form cysts; the dog becomes infected by swallowing the infected fleas and lice.

Treatment.—This is the same as detailed above for the other dog tapeworms.

(B) *Roundworms.*

(1) *The Dog Ascaris (Belascaris marginata).*

Two kinds occur in dogs. Their life history is similar to pig ascaris. They cause loss of condition.

Treatment.—Fasting for twenty-four hours and dosing with oil of chenopodium, $\frac{1}{2}$ drachm, and chloroform, $\frac{1}{2}$ drachm, in an ounce of castor oil.

(2) *The Hookworm.*

This is found in the small intestines. It is a small worm about half an inch in length, and is responsible for loss of condition, anæmia and digestive disturbances.

Life History.—The eggs after being voided, hatch in moist soil and the larvæ probably penetrate the skin and are transported by the blood stream to the lungs and ascend the windpipe to the mouth or are coughed up. After being swallowed they develop into adults in the small intestines.

Treatment.—The same as for ascaris in dogs. (See above.)

SOME POISONOUS PLANTS OF KENYA.

The flora of tropical African contains numerous poisonous species, many of which, although well known to the natives are still unknown to European science. It is only by degrees that information about poisonous plants is being accumulated, but it is being realised more and more that poisonous plants are responsible for a heavy annual loss amongst cattle and sheep in this Colony. During the past two years many plants have been experimented with and it is significant that nearly 50 per cent of the plants tested have proved to be highly toxic for sheep.

Poisoning by plants may occur under a variety of conditions depending on climatic, telluric and atmospheric factors which are not always very clear; for instance, certain grasses may be highly toxic for herbivorous animals when they are wilting. This particular toxic phase is generally very ephemeral and is lost after the next shower of rain. Undoubtedly hydrocyanic acid poisoning produced by the ingestion of certain wilting grasses is not uncommon in tropical Africa for many species of the most typical Central African grasses, e.g. eragrostis, cymbopogon, andropogon, etc., produce hydrocyanic acid in considerable amounts during wilting before the rains. Ingestion of grasses containing toxic amounts of this acid produces very sudden death either without premonitory symptoms or preceded by a very transient nervous excitement followed by coma and death. The extent to which hydrocyanic acid poisoning following the ingestion of grasses occurs in this Colony is quite unknown but it may explain, partially at any rate, those cases of sudden death that are noticed during droughts in animals grazing on parched or wilting veld.

Not every part of a plant may be poisonous. Some parts may be much more potent or virulent than others. Thus the berries of black nightshade, the seeds of *Datura stramonium*,

the leaves and twigs of acokanthera and the roots of the various umbelliferæ are the most poisonous parts of these respective plants. Generally, however, when one part of a plant is toxic the rest of the plant also contains the same poison but, it may be, in considerably smaller and perhaps non-toxic amounts.

Different classes of live stock vary considerably in their susceptibility to poisonous plants. Animals born and bred on a farm appear to possess an inborn instinct as to what is wholesome to eat and what must be avoided. Poisoning undoubtedly is most common in imported animals or in animals introduced on to the farm from a different part of the country where the vegetation and grazing are different, but it is a well-recognised fact that there is no accounting for the appetite or taste of stock and this is particularly true of sheep.

The effects of plants on animals vary considerably, depending mainly on the chemical nature of the toxic principle of the plant and its specific action on some particular organ or system of the host that has eaten the plant. One poison may act differently on two distinct species of animal, e.g. the toxin of *Senecio latifolius* has a specific action on the liver of horses and the alimentary canal of bovines. Many plants contain more than one toxic principle each of which may act specifically at the same time on a particular body tissue. Some plants, not poisonous in the real meaning of the word, do much damage by tainting the milk of dairy cows or the flesh of beef breeds while others cause mechanical damage especially to the feet and mouth region. Examples of the latter are plants provided with thorns or spikes, e.g. *Tribulus terrestris*, various acacia, etc., while examples of the former are water parsnip (*Sium latifolium*), worm-wood (*Artemisia afra*), wood-sorrel (*Oxalis acetosella*), and the various wild garlics (*Allium* species), etc.

In the following table (obviously incomplete) a brief list is given of plants known to be poisonous for stock in this country. Experience in Southern Africa is that the list of plants toxic for animals is a very formidable one and there is no doubt that many plants whose toxicity has already been elucidated in the southern parts of this continent occur in this Colony and are doubtless equally toxic here. It is only by the steady accumulation of data furnished by farmers and by the collection and experimentation of plants that anything like an adequate knowledge can be obtained of this important subject. Farmers are invited to assist in this investigation by sending to the Laboratory for further research any plant or vegetable material which they regard with suspicion.
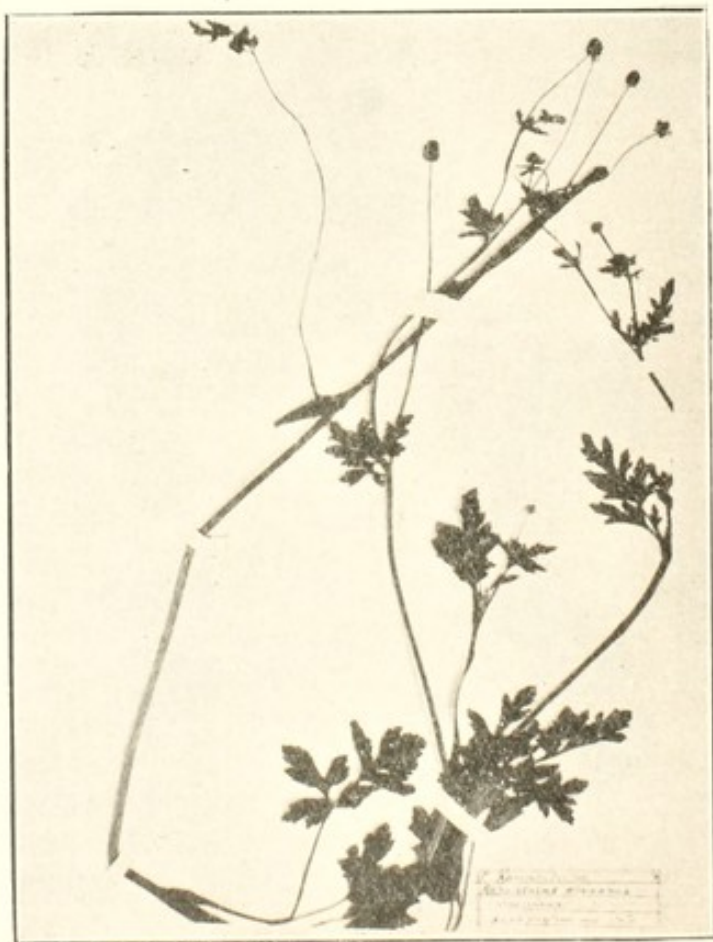
NERIUM OLEANDER.
Family: *Apocynaceæ*

ACOKANTHERA SCHIMPERI.
Family: *Apocynaceæ*.

SOLANUM NIGRUM.
Family: *Solanacea*.

RANUNCULUS PINNATUS.
Family: *Ranunculaceæ*.

ASCLEPIAS PHYSOCARPA.
Family: *Asclepiadaceæ*.

DATURA STRAMONIUM.
Family: *Solanaceæ*.

DICHROCEFHALA CHRYSANTHEMIFOLIA
Family : *Compositæ*

POISONOUS PLANTS OF KENYA.

Name of Plant.	Vernacular or Common Name	Family.	Part of Plant Poisonous.	Symptoms of Poisoning.	Post-mortem Lesions.	Remarks.
Acokanthera Schimperi	Muricha (Kikuyu) Ol-Morigye (Masai)	Apocynaceae	Fruits said to be edible. Leaves, twigs, branches and roots are very toxic.	Uneasiness. Frequent urination and defaecation. Blowing respirations up to 100 p.m. Salivation, chopping of jaws, great thirst and muscular spasms are chiefly seen. Soon a foetid pultaceous green diarrhoea supervenes. The pupils become widely dilated and there are marked tremors or spasms of the muscular system. The white of the eye becomes deep red or bluish in colour and respirations very rapid and difficult. There may be marked diuresis. All these symptoms increase in severity until death very suddenly supervenes.	Acute congestion or inflammation of the entire digestive system. There is no ulceration, but the lining membrane is a deep port-wine colour. The blood is tarry and liquid, while the heart is very firmly contracted. The lungs are very swollen and appear too large for the chest. They show impressions caused by the ribs, are saturated with a pink foamy liquid and very doughy in consistence. Liver, kidneys and spleen are very congested.	Both these trees are very similar in appearance and grow in fairly dry country and in savannah land. A. schimperi contains a more highly toxic alkaloid than A. longiflora, but for all practical purposes both trees are highly poisonous for any animal that grazes on them. The flowers grow in clusters, are highly scented like jasmine, are small and succeeded by fruits not unlike a damson. The leaves are opposite to one another on branches or stems and have a deep green, glossy appearance and vary in length from one to four inches. Both trees are more or less lactiferous. The symptoms are very similar to acute strychnine poisoning, but the foetid diarrhoea is very characteristic of acokantherosis. Other diseases with which this poisoning may be confused are heartwater and anthrax.
Acokanthera longiflora	Mururu (Kikuyu)	Apocynaceae	Fruits said to be edible. Leaves, twigs, branches, and roots are very toxic.			

POISONOUS PLANTS OF KENYA.—(Contd.)

Name of Plant.	Vernacular or Common Name	Family.	Part of Plant Poisonous.	Symptoms of Poisoning.	Post-mortem Lesions.	Remarks.
Leonotis mollissima	Ol-jujunoi (Masai) Muchii (Kikuyu)	Labiatae	Leaves, flowers and stems.	In experimental cases no clinical symptoms have ever been noticed. The animal may appear to be drowsy, lethargic and lie about continuously. In no case, however, was there any clinical symptoms.	There was an acute gastro - enteritis, while a dark red fluid oozed from mouth and nostrils. Lungs were oedematous and congested, while there was marked fatty degeneration of liver and kidneys.	A common herb up to six feet high, easily recognised by its orange-red flowers, produced in dense whorls, by its four-sided stems and branches and by the general prickly character of the plant. It grows in profusion throughout the Highlands, especially near native villages, on neglected shambas, and on lands allowed to go out of cultivation.
Adenia (modecca) Species?	Kikiroma (Kikuyu) Wild Passion Flower Wild Grenadilla	Passifloraceae	Root. Fruits are said to be edible.	Salivation, chopping of jaws, lying down and getting up in succession, diuresis, anxious expression and hurried respirations. Profuse dark-coloured diarrhoea which stains wool of hindquarters. Grinds teeth and expression is very anxious. Death occurs from exhaustion following acute abdominal symptoms.	Marked inflamation of small intestines and to less extent of stomach. Marked congestion of spleen, kidneys, liver and lungs, while latter are also very oedematous.	This root is commonly used by Meru natives as a jackal poison, and in one known case by a native poisoner. Probably the fresh root eaten raw is more toxic than when dried and powdered, on account of the high content of hydrocyanic acid the fresh root contains, but even when desiccated the root contains a very powerful poisonous alkaloid. The rest of the plant is said to be non-toxic. Owing to insufficient material being sent it was not possible to determine the exact species of this plant.

POISONOUS PLANTS OF KENYA.—(Contd.)

Name of Plant.	Vernacular or Common Name	Family.	Part of Plant Poisonous.	Symptoms of Poisoning.	Post-mortem Lesions.	Remarks.
Cassia didymobotrya	Wild Senna *Mwena* (Kikuyu) *Ol-Senetoi* (Masai)	*Leguminosae*	Leaves.	Uneasiness, salivation. White of eye is very congested and even blue in colour. No symptoms may be noticed and animal found dead. May be acute diarrhoea.	Marked inflammation of small intestine and acute congestion of kidney, liver, spleen and liver. Blood very dark. Haemorrhages inside heart.	Death is very sudden and quite unexpected. This particular small tree grows near water and is readily recognised by its racemes of yellow flowers topped by unopened black buds. An infusion of leaves is used by the Masai as a laxative.
Cucumis prophetarum	Wild Cucumber *Kikungue* (Kikuyu)	*Cucurbitaceae*	Whole plant.	Profuse foetid green diarrhoea. Salivation. Rapid respirations. Moaning and grinding teeth. Foaming at mouth. Marked depression. White of eye is very congested.	Marked inflammation of stomach and intestines. Ulcers may also be present in stomach and mouth. Congestion of all organs and oedema of lungs.	This plant is a common creeper in grass and may be recognised by its fruit and very prickly leaves and stems. It has the typical appearance of a member of the cucumber or melon family and should be very readily recognised. A very poisonous plant.
Dichrocephala chrysanthemifolia	*Kamugwata Ng'ondu*	*Compositae*	Leaves, flowers and stems.	Profuse green pultaceous diarrhoea, which becomes foetid. Animal very ill, stands with back arched and head depressed. Lies down frequently. Respirations rapid. Death is preceded by coma.	Marked congestion of stomach and bowels though not so marked as in Cucumis poisoning. Congestion of spleen, liver and kidney.	This is an annual herb common in grasslands in damp localities. It also grows profusely in waste lands and deserted shambas. The flowers are crowded into dense heads and often have a purplish hue. The leaves bear a certain resemblance to those of chrysanthemums. A very poisonous plant.

POISONOUS PLANTS OF KENYA.—(Contd.)

Name of Plant.	Vernacular or Common Name	Family.	Part of Plant Poisonous.	Symptoms of Poisoning.	Post-mortem Lesions.	Remarks.
Asclepias platycalyx	Milk weed and weed Maania (Kikuyu)	Asclepiadaceae	Whole plant.	There may be none at all, the animal being found dead. In some cases there may be marked depression, diarrhoea, and hurried respirations.	Numerous haemorrhages inside heart. Congestion of spleen, liver and kidneys. Marked congestion of stomach and throat. Congestion and oedema of lungs.	This is a woody herb with linear leaves, whitish clustered flowers and numerous remarkable bladder-like fruits which are covered with bristles. The whole plant has an acrid white, milky juice, which exudes when any part of the plant is injured. It grows commonly in damp localities in grasslands throughout the Highlands of the Colony.
Ranunculus pinnatus	Wild Buttercup Maradia (Kikuyu)	Ranunculaceae	Every part but flowers most so and followed in order of toxicity by leaves and stems.	Ropy salivation, twitching and trembling of lips, ulceration or excoriation, with congestion of lips, tongue and palate. Congestion of conjunctiva. Animal stands with head depressed, is off its feed, urinates freely and has a laxative action of the bowels. These symptoms steadily increase in severity and the buccal lesions may be very acute. There is a temperature up to 106oF. which falls before death.	Marked ulceration and inflammation of mouth, pharynx and digestive entire canal. The mucosa is a deep claret colour and reminiscent of rinderpest. Congestion of spleen, liver and kidney. Haemorrhages in heart; congestion and oedema of lungs.	Both clinical and post-mortem lesions are very suggestive of rinderpest, which disease should be excluded before a diagnosis of Ranunculus poisoning is given. All the wild buttercups should be regarded with suspicion as they contain an acrid bitter juice which is extremely irritating. This is particularly true when the plant is flowering. The irritant juice disappears when the plant is dried so that the plant causes no damage when fed as hay. In Kenya this plant grows profusely near water or in marshy lands.

POISONOUS PLANTS OF KENYA.—(Contd.)

Name of Plant.	Vernacular or Common Name.	Family.	Part of Plant Poisonous.	Symptoms of Poisoning.	Post-mortem Lesions.	Remarks.
Nerium oleander	*Oleander* Ceylon Rose	*Apocynaceae*	Every part is very toxic.	There is abdominal pain and loss of appetite, while the white of the eye assumes a jaundiced colour. Diarrhoea supervenes and is very persistent. Before death occurs there are convulsions, insensibility and paralysis. Respirations are greatly increased in rate, while there may be two or three degrees of fever.	Intense congestion or acute inflammation of the small intestine and to a lesser extent of the large bowel. The stomach may be unaffected or slightly congested. The bowel contents are liquid and bloody.	The oleander is an ornamental plant found commonly in gardens. It is extremely poisonous for all animals and cases occur frequently in man. The flower has a heavy sick odour and, as in all other apocynaceous plants, there is an abundant milk in the plant which contains the poisonous alkaloid in considerable quantities.
Datura stramonium	Thorn Apple	*Solanaceae*	Mainly the seeds.	Mainly affected the nervous system, e.g., staggering gait, dilated pupils, rapid pulse, convulsions, stupor, partly open mouth and a dry tongue. Death occurs after a prolonged coma.	These may be very vague and consist of a mild congestion of stomach and bowel. The seeds may be found if the bowel contents are carefully examined.	This is a noxious weed and grows in neglected shambas, etc. It has large leaves with pointed teeth or lobes. The flowers are white, solitary, and trumpet-shaped. The fruit is nearly globular, very prickly and contains at least three alkaloids, each of which is deadly poisonous.

POISONOUS PLANTS OF KENYA.—*(Contd.)*

Name of Plant.	Vernacular or Common Name	Family.	Part of Plant Poisonous.	Symptoms of Poisoning.	Post-mortem Lesions.	Remarks.
Sium thunbergi	Water Parsnip	*Umbelliferae*	Every part, but especially the root.	Great dullness and depression. Animal shakes or rotates its head. Deep, sonorous respirations. Drowsy. Respirations hurried to 80 p.m. Eyelids heavy and expression dull. Frequent sighing and grinding of teeth. Animal tends to support head. If animal survives a few days a mild foetid diarrhoea supervenes.	Acute congestion or inflammation of the stomach and intestines; acute oedema and congestion of the lungs. Congestion of liver, spleen and kidneys. Petechial haemorrhages on inside and outside lining of the heart.	These are smooth herbs which grow in marshy places or even in water. In dried-up river beds they may be found under the decayed vegetation running in a prostrate manner. The leaves are very green, much decomposed with serrate borders. The leaves are compared by many natives to the leaves of the larger ferns. The root is long and tapering. It breaks easily and has a distinct parsnip-like odour, hence the synonym for the plant " water parsnip ". The plant is stoloniferous, *i.e.* its branches, which run over the ground, strike roots at the nodes. Every umbelliferous plant should be regarded with suspicion. These plants, because of the close analogy of their leaves with those of the carrot or parsley are readily recognised.

POISONING BY SOME OF THE COMMON CHEMICALS.

Certain chemical agents are commonly used on farms, and may lead to cases of poisoning amongst the domestic animals, e.g. arsenic, strychnine, lead, etc.

Common salt in large doses is a deadly mineral poison for certain animals, particularly the pig and fowl. In this article poisoning by common salt, arsenic, lead and strychnine will only be discussed.

POISONING BY COMMON SALT.

Salt itself rarely causes poisoning; more often fatal cases are observed following the use of liquors derived from the salting or boiling of meat, or from salted potatoes. Brine is very toxic for swine, and care must therefore be exercised in feeding these animals in places where brine and other salty solutions are used for various domestic purposes. Similarly salted meal or potato mashes should be given to fowls with the greatest caution.

Symptoms.

(a) *In Swine.*—Symptoms are salivation, great thirst, diarrhœa or constipation, while the animal sits on its haunches like a dog. Nervous symptoms then supervene, e.g. giddiness, blindness, dilation of the pupils, and convulsions. Death occurs in convulsions after an illness of three days or so.

(b) *In Fowls.*—Symptoms are mainly nervous, but there may be marked muscular tremors, progressive difficulty in walking, and finally complete inability to stand or rest on the perch. Great thirst also exists, and there may be viscous discharge from the beak.

Post-mortem Lesions.

General inflammation of stomach and intestines is observed, while the blood is dull red and coagulates rapidly.

Treatment.

There is no specific drug treatment. White of egg or gruel or milk should be given with a sedative, such as laudanum. If possible, administer an emetic to empty the stomach.

POISONING BY STRYCHNINE.

Cases of strychnine poisoning occur quite frequently on farms where this alkaloid is used for the destruction of rats or other vermin, e.g. leopard, jackal, etc. Cases of poisoning

occur mainly in the smaller domestic animals, but cattle and horses may also be fatally poisoned.

Symptoms.

In all animals strychnine is a powerful nerve stimulant, and its symptoms are generally easily recognised. There are very marked general tetanic spasms during which the back is arched and the respirations are stopped. The animal becomes remarkably sensitive to external stimuli, e.g. noise, light, heat, cold, etc. Death results from asphyxiation. Vomition is common in the dog, while the temperature may be elevated one or two degrees.

Poisoning by strychnine may be confused with tetanus (lockjaw), but the spasms are clonic in strychnine poisoning and tonic in tetanus. Tetanus is very rare in cattle and dogs, but strychnine poisoning is not uncommon in these animals.

Post-mortem Appearances.

These are very vague and are mainly those of asphyxia. There is always more or less marked rigidity of the muscular system, especially of limbs and jaws.

Treatment.

First of all an emetic must be given to rid the stomach of any toxic material. The ordinary emetics in general use are quite efficacious. Keep the animal quiet, and away from all external stimuli. To combat the nervous and muscular symptoms a general sedative is indicated, and the best of all is chloral (6 grammes for a dog).

POISONING BY LEAD.

Lead poisoning is not uncommon and causes a small loss every year on certain farms. Its prevalence in this Colony has not yet been determined, but its presence has been suspected on more than one occasion.

The disease occurs particularly in cattle and dogs. In the former animal it results from eating white paint or red lead or chewing old painted canvas, etc., while dogs are poisoned as a result of licking wet paint. Every precaution should be taken to remove old paint tins or cans from grazing land, as the omnivorous appetite of many cattle does not stop at the chewing of any article containing paint.

Symptoms.

(a) In Cattle.—The chief symptoms are nervous in character, and are those of increasingly pronounced paralysis of both voluntary and involuntary muscles through the motor

nerves. In addition, there are symptoms of intense colic, convulsions and coma, which are soon followed by death in acute cases. The dung is very hard and black, the breath fœtid, and the urine very ropy. Very often there are marked symptoms of delirium.

In chronic cases, characteristic blue lines appear on the gums, while there are also symptoms of intermittent abdominal pains, great thirst, alternating diarrhœa and constipation, emaciation, debility, paralysis and death.

Symptoms in horses are similar but the brain symptoms are very pronounced, and there is a characteristic " roaring " in working horses which at once attracts attention. As in cattle, plumbism is generally very fatal.

Generally, plumbism runs a protracted course for many weeks or even months.

Post-mortem Lesions.

The commonest lesion is a more or less marked inflammation of the intestines and fourth stomach, while small pellets of lead, black on the surface, but white internally, may be found in the ingesta.

Death is very rapid and no post-mortem lesions are observed in cases poisoned by the easily soluble lead preparations.

Treatment.

Remove, if possible, the already ingested lead by a good emetic or a saline purge. For all practical purposes the stomach-pump is useless in bovines and equines, so that the most efficacious treatment is to administer a full dose of either Epsom- or Glauber's salt. Both these salts form an insoluble sulphate of lead, which is expelled by the purgative action of the drug. Subsequently, full doses of iodide of potassium should be given to complete the elimination of the poison.

Poisoning by Arsenic.

Arsenic poisoning is the commonest mineral poison in Kenya, and occurs especially in cattle and sheep, but cases crop up from time to time in horses, swine and dogs. The cause is obvious, and is nearly always traceable to the malicious or accidental administration of some cattle dip or weed-killer containing a high amount of a soluble arsenic salt.

Symptoms.

Poisoning by dip or weed-killer is generally very rapid in its course. There is acute abdominal pains, depression, salivation, and in all animals the diarrhœa often becomes bloody. Nervous symptoms appear towards the end of the illness, e.g. trembling, paralysis of the hindquarters, stupor and convulsions.

In many cases death may occur without any premonitory symptoms. Chronic poisoning is very rare in animals. It is evinced by great wasting, lameness, gradual abolition of all motor and sensory function, and great thirst.

Post-mortem Appearances.

There is intense inflammation of stomach and intestines, so that the mucosa is a deep claret colour and often eroded. There may be congestion and, in protracted cases, fatty changes in the liver, heart and kidneys. Arrest of decomposition is a noticeable feature of arsenical poisoning.

Diagnosis.

Arsenical poisoning may be confused with anthrax, but examination of blood smears will soon decide the presence or otherwise of anthrax. An accurate diagnosis of arsenical poisoning, however, can only be made by analysis of the contents of the stomach and intestine or of the unfixed liver, skin, etc.

Treatment.

Emetic and purgatives must first be given, followed by such demulcents as white of egg, milk and lime water in liberal quantities. Freshly prepared precipitated ferric hydroxide is a specific or, in an emergency, tincture of ferri perchloride may be treated with a solution of washing soda and the filtered mixture administered *ad lib.* in warm water.

If pain is very severe morphia may be given, while in cases of marked nervous depression subcutaneous inoculations of ether or strychnine are useful.

SNAKE-BITE.

Snake-bite is said to cause a certain mortality every year, but undoubtedly many cases are confused with some of the infectious diseases, especially anthrax and blackquarter. Horses, cattle, sheep, goats, dogs and man are all susceptible to snake bite, while cats and pigs are less commonly affected, not because they are immune, but because they are expert destroyers of snakes.

Recognition of a Poisonous Snake.

A poisonous snake is readily identified by examination of its upper teeth. Harmless snakes have two long rows of teeth on each side of the upper jaw, while a poisonous snake, like the cobra or puff adder, has on each side one long row external to which is a single fang. This fang is merely grooved in the cobra species, but in the adders or vipers the fang is tunnelled by a canal; in any case, the fang communicates with the poison gland which lies posterior to the eye. A bite of a harmless snake generally produces two double rows of small punctures, whereas a poisonous snake causes two single rows, with one large puncture external to each row.

Period of Incubation after being Bitten.

Symptoms may appear practically as soon as the snake has bitten or they may be delayed for many hours or days. Many factors influence the rapidity of the appearance of symptoms after biting, e.g. age, size and type of snake, potency and dose of venom, season of year, length of time since last snake-bite, etc.

Types of Poisoning.

There are two distinct types of snake venom, viz.—

(a) Colubrine (cobra type), and

(b) Viperine (adder type).

There are many symptoms common to poisoning by both types of venom, but colubrine venom exerts its action on the nervous system (particularly the respiratory centres), while viperine venom acts mainly locally.

Symptoms of Colubrine Poisoning.—The main symptoms are excitement, restlessness, muscular tremors, with respiratory difficulties. Asphyxia frequently causes death, especially in sheep and dogs. If death is not rapid there is marked depression, enlivened by intervals of great excitement, but as a rule the animal is very depressed until it dies or recovers. Pain may be evinced as well as profuse perspiration, continual movements of head, tail and limbs, salivation and defæcation. There is no alteration of temperature—a point of some importance in the differentiation of snake-bite from an infectious disease. No local swelling may be observed in very acute cases, but in prolonged cases it is very pronounced. The lesions may be soft, painless and pendulous, or hard, warm and

very sensitive. In cases of recovery these swellings may persist for weeks and are slowly absorbed. If the swelling is incised it is found to be due to an infiltration with yellow, often hæmorrhagic, fluid in which may be pieces of necrotic material.

Symptoms of Viperine Poisoning.—Generally the constitutional symptoms are similar to what has been described above, but in addition the local swelling and pain are very pronounced. This swelling appears within a quarter of an hour of being bitten, and may assume an enormous size. At first soft, it rapidly becomes tense, warm and very painful, while the skin assumes a livid discoloration. Inco-ordination, paralysis, and the pronounced brain symptoms noticed in colubrine poisoning have never been observed in patients bitten by members of the viper family. On opening the swelling the subcutaneous tissues are infiltrated with a deep red gelatinous liquid and material, while livid areas are found around the punctures.

Diagnosis.

This may be very difficult or impossible where no reptile has been actually seen near the affected animal, or in cases where punctures by the fangs cannot be found. Diseases like blackquarter, anthrax or malignant œdema must be excluded, and the absence of a high temperature is a valuable aid in this respect. The great local pain, pronounced pendulous œdema, the fang punctures (which may be bleeding), and the onset of nervous or respiratory symptoms are typical of snake-bite. The diagnosis is much easier on farms where anthrax, blackquarter, or malignant œdema are not prevalent.

Treatment.

If possible, apply a tight ligature above the bitten part, and leave on for at least half an hour. Freely incise the area over and about the punctures to encourage hæmorrhage, and compress the wounds to assist in expelling any venom. Rub into the wound crystals of potassium permanganate, and cover it with a compress soaked in a solution of the same drug. General treatment is also indicated to maintain the animal's strength, e.g. stimulants such as hot coffee, alcohol, or subcutaneous injection of strychnine. If possible a dose of specific anti-venom serum should be administered without delay, but in most cases this substance is neither handy nor available.

PART II.

Laboratory Methods Employed in the Diagnosis of Contagious Stock Diseases.

As treatment of disease is of necessity empirical and may not be successful until the cause is established, it is of paramount importance that an early positive diagnosis should be made. As will be seen from Part I of this pamphlet, the clinical symptoms of many of our stock diseases are similar to some degree, and unless outstanding and diagnostic signs are present no one is justified in asserting the identity of the condition under examination. Other methods of diagnosis must in such cases be employed, and as a rule these should follow the lines outlined below.

2. It is often difficult—impossible, in fact—in cases where farmers are living at great distances from this Laboratory, to submit specimens to us for examination quickly enough to ensure a reply being received in time to indicate the steps to be taken. In such instances, and particularly when immediate action is indicated, as for example with highly contagious diseases, specimens should be sent to the nearest veterinary officer. These officers are nowadays equipped with sufficient laboratory appliances to make microscopical diagnosis in many instances.

3. It must be remembered that pathological research is not quite equivalent to a chemical analysis which can be conducted by a series of scheduled tests, each of which affirms or negatives the presence of a particular substance. We are dealing with materials capable of undergoing profound modification through decomposition, and usually with a very limited amount spread for microscopical purposes on a glass slide. If not so spread, it will decompose, and the microbes causing decomposition become so numerous as to entirely disguise the real cause. Again, although for some diseases there do exist certain definite tests, the manner in which the material is collected may entirely preclude their application.

4. It is requested therefore that in collecting and submitting specimens for laboratory diagnosis, great care should be taken to carry out the following instructions as closely as possible.

A.—METHODS OF FORWARDING MATERIAL TO LABORATORY FOR DIAGNOSIS.

We strongly urge the necessity of cleanliness in the handling and therefore comparative purity of the samples to be examined. In all cases an endeavour ought to be made to eliminate dirt and, if possible, alien bacteria, which abound on all open surfaces and particularly in decomposing carcasses.

1.—GLASS SLIDES.

A stock of these should be at hand always, together with postal wrappers which, with other articles here mentioned, can be obtained on application from the nearest veterinary officer or direct from the Laboratory. Slides, which should always be sent in duplicate, are used for the collection of blood, pus, organ smears, etc., when the disease-producing organism is one which can be detected by direct microscopical examination. (The disease organisms which can be so detected on a slide will be stated later.)

When forwarding slides or other material from a sick animal, a full description of the nature of the illness should be clearly stated.

2.—SWABS.

These are sterile plugs of cotton wool fitted into sterile tubes and enclosed in a wooden case. They are used to collect material for more detailed tests than are possible with slides. The materials usually collected are : Blood or organ substances in diseases like Kikuyu fowl disease ; pus from an abscess, either externally or occurring within the body ; other fluids where there is a suspicion of bacterial cause. The materials collected must be pure of themselves, if possible, and the cotton-wool plug must not touch anything but the material being collected for examination.

3.—SMALL BOTTLES.

These are used principally for the purpose of collecting samples of blood which require special examination, as for example for the detection of contagious abortion.

4.—GLASS TUBES.

These may either contain preservatives or not. Materials which can be sent in them without preservative are : Dung, in its natural state, for the detection of worm infections ; skin scrapings for mange, ringworm and streptothricosis.

Those with preservatives contain :—

(a) O.C.G. mixture, which prevents the coagulation of blood and preserves the virus of horse-sickness, swine fever and bluetongue.

(b) Citrate solution, which prevents the coagulation of the blood in rinderpest and other diseases, the viruses of which are killed by the O.C.G. solution.

(c) Formalin, for the preservation of portions of organs and tumours destined chiefly for histological investigation. Samples of worms and ticks can also be sent in it.

(d) Tick preservatives, for the preservation of ticks, lice, fleas and such insects. Biting flies should not be put in fluids.

Labels should always be addressed distinctly to expedite despatch, to the Chief Veterinary Research Officer, Veterinary Research Laboratory, P.O. Kabete, or by rail to Kabete.

B.—METHODS OF COLLECTING MATERIAL FOR EXAMINATION OR TESTS.

1.—BLOOD SLIDES.

The most suitable place from which to take blood in live animals is the ear. The head should be firmly held, the hair should be clipped off a small area on the edge of the ear, and the clipped surface wiped in order to get rid of any dirt. With a pair of sharp scissors or a knife make a small cut on the cleaned edge. On the appearance of a drop of blood, it should be touched with the middle of one of the narrow edges of a clean slide. The end with the blood on should be placed on a second slide (which must be clean and free from dust or grease), holding it at an angle of about forty-five degrees. When the blood has spread out in the angle between the two slides and along the edge of the vertical slide, this should be drawn along the surface of the horizontal one, as illustrated.
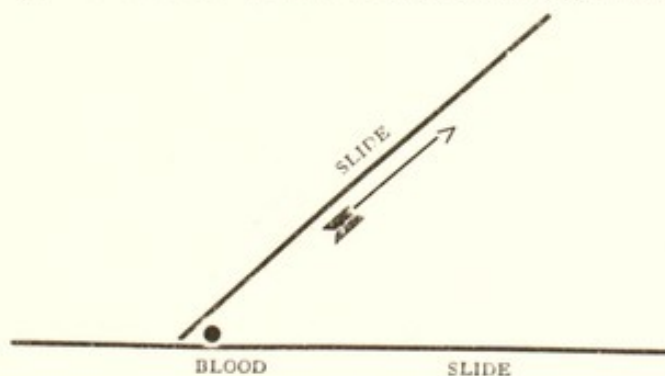
BLOOD   SLIDE

The blood must be spread extremely and uniformly thin—if too thick, microscopical diagnosis cannot be made—and the smear dried quickly by waving in the air. The wet surfaces of slides must not be placed together on any account.

2.—GLAND SLIDES.

The animal should be well secured and the gland in front of the right shoulder firmly grasped with the left hand. The skin over the area should be clipped and cleaned, and the needle of a hypodermic syringe thrust into the gland and slightly moved from side to side. The syringe with piston closed is then attached to the needle and when the piston is pulled outwards some of the gland substance is squirted from the needle on to a slide. With the aid of a second slide a thin smear is then made in the same manner as in making a smear from the blood. When the glands are enlarged as in recently infected cases of East Coast fever, the insertion of the needle alone is usually sufficient to obtain enough gland substance without the necessity of resorting to aspiration with a syringe.

3.—ORGAN SLIDES.

Collect a little material from a freshly cut surface of the organ by scraping with the end of a clean slide, and proceed as if the material collected were blood. In making the cut with a knife used for the post-mortem examination, great care should be taken to thoroughly clean the instrument first, either by washing and drying or by making a series of cuts with the knife from the last of which the smear should be prepared; this will tend to eliminate the presence of micro-organisms being conveyed by the knife from the intestines or other organs.

4.—PUS SLIDES.

When pus slides are being made from a suspected lymph-angitis or other lesions, a fresh abscess should be washed with disinfectants and punctured with a clean knife. Pus collected from open sores is as a rule contaminated with numerous species of bacteria which render positive diagnosis difficult or even impossible.

5.—SWABS.

Swabs are issued chiefly to enable suitable material to be collected for more detailed tests than are possible with slide examinations, as for example in Kikuyu fowl disease, when it is inconvenient to send a sick or dead fowl, or in collecting specimens of pus from lymphangitis abscesses when it is desired that a special vaccine be prepared.

They are sterilized before issue, and should on no account be opened before they are required. The wooden case contains a glass tube in which fits a cork carrying a wire and a small pledget of cotton wool. In Kikuyu fowl disease swabs should be made from the liver soon after death. In collecting material on the swab the cotton wool should be removed from the tube by means of the cork, and having been allowed to saturate itself in the material being collected, it is immediately replaced in the tube. This is then returned to the wooden case, which should be sealed and forwarded direct to the Laboratory by the most expeditious route.

The cotton wool should on no account be allowed to come into contact with dirt or any part of the skin.

6.—SMALL BOTTLES.

Method of obtaining blood from the ear for the contagious abortion test :—

Having secured the animal by the head and washed the skin over the jugular furrow with a disinfectant, apply a noose of thin soft cord or thick twine to the lower part of the neck and allow an assistant to tighten it until the distended vein can be felt distinctly with the fingers. Introduce the needle of a hypodermic syringe through the skin over the middle line of the vein and carry the point with a sudden thrust into the vessel. As soon as this has been done, a steady stream of blood should issue from the needle, and it ought to be allowed to flow direct into the sterile bottle from which the cotton-wool plug has been removed. If the bore of the needle is too small it may be necessary to attach the syringe and abstract the blood by suction.

After operating on an animal, the needle and the syringe also, if that has been used, should be rinsed out with water that has been boiled and allowed to cool, before proceeding to the next animal. If the syringe is used, see that no water is left in the barrel.

For the purpose of the test about one ounce of blood is required from each animal. Each sample should, of course, be sent in a separate bottle. To each bottle is attached a sterile cork. After the bottle has been tightly corked, it should be set on one side until the blood has completely coagulated. Each bottle should be marked for the purpose of identification with the name or number of animal, and the package itself should be labelled on the outside, " Urgent," and " Abortion."

7.—PRESERVED BLOOD.

When collecting in O.C.G. solution or into citrate, it is easiest obtained by bleeding the animal from the jugular vein according to the method just described.

In the case of pigs and often with small animals of inconsiderable value, it is advisable, unless the operator be practised, to destroy the animal by pithing and then cut its throat and collect the blood as it spurts from the arteries.

8.—FORMALIN AND OTHER PREPARATIONS.

Worms for identification should be washed in clean water and then transferred to this solution. In sending pieces of diseased organs, quality and not quantity is essential. Pieces not larger than half an inch square and a quarter of an inch thick should be cut so as to include the representative parts of the abnormal tissue, and then be immediately dropped into the solution. Ticks, fleas and lice for identification are similarly placed in their preservative. When required for breeding or testing purposes, these insects should be sent in dry tubes, the corking of which will not affect their vitality for several days.

C.—DISEASES WHICH CAN BE DIAGNOSED MICROSCOPICALLY AND THE ORGANS OR SPECIMENS REQUIRED FOR DIAGNOSIS.

Anaplasmosis.—Blood or spleen slides, or both.

Anthrax.—Blood slides made from the ear blood.

Bacillary Necrosis.—Pieces of the necrotic tissue in formalin solution, or preferably an affected animal.

Biliary Fever of Equines.—Blood or spleen slides, or both.

Blackquarter.—Slides from the diseased muscle, as well as small pieces of the affected muscle about as thick as the little finger, which have been dried in the shade.

Contagious Bovine Pleuro-pneumonia.—Several small portions of diseased lung in formalin solution.

East Coast Fever.—Gland or spleen slides, or both.

Fowl Diphtheria (Fowl Pox).—A sick or recently dead bird.

Heartwater in Sheep, Goats or Cattle.—Small pieces of the brain, spleen and kidneys, collected immediately after (or preferably just before) death, in formalin solution. In addition, it is advisable to send blood in citrate solution collected during the temperature reaction to reach the laboratory within a few hours after collection.

Kikuyu Fowl Disease (Fowl Typhoid).—Preferably a sick bird.

Laikipia Lung Disease of Sheep.—Preferably a sick sheep, or failing this a portion of the diseased lung in formalin solution.

Lymphangitis : Ulcerative or Epizootic.—Pus slides from a newly opened abscess when available.

Pleuro-pneumonia of Goats.—Preferably a sick goat.

Redwater.—Blood or spleen slides or both.

Streptothricosis and Other Skin Diseases.—Scrapings of the skin lesions ; preferably an affected animal.

Tick Fever of Dogs.—Blood or spleen slides, or both.

Trypanosomiasis or Fly Disease.—Blood slides taken on several days.

Tuberculosis.—Slides of the diseased areas.

Worm Infections.—Dung or specimens of the worms in formalin solution or methylated spirits.

D.—DISEASES WHICH REQUIRE SPECIAL TESTS AND MATERIAL REQUIRED.

Arsenical Poisoning.—Portions of the stomach and liver in formalin solution.

Bluetongue.—Blood in O.C.G. preservative.

Colon Bacillosis.—Preferably a sick calf ; failing this, portions of the fresh liver, spleen, intestines and mesenteric gland, not in preservative. Blood and gland smears of the sick beast. Blood in citrated bouillon.

Contagious Abortion of Cattle.—Blood in small bottles.

Horse Sickness.—Blood in O.C.G. preservative.

Paratyphoid of Calves.—Preferably a sick calf; failing this, portions of the fresh liver, spleen, intestines and mesenteric gland, not in preservative. Blood collected sterile in bottles containing sterile medium, viz. citrate bouillon. Blood and gland smears of the beast should also be sent.

Plant Poisoning.—Specimens of the suspected plant, to include the root, stem, leaves and flowers.

Rinderpest.—Blood in citrate solution, to arrive at the laboratory within twenty-four hours of collection.

Sheep Pox.—Preferably an affected sheep.

Swine Fever.—Blood in O.C.G. preservative.

E.—METHOD OF MAKING A POST-MORTEM EXAMINATION.

If an animal dies suddenly, and anthrax is suspected, the carcass should not be opened, but a blood smear could be made from the ear and the carcass burnt in situ.

When blackquarter is suspected, a smear could be made from the affected muscle, and a small strip or two of affected muscle cut off for drying and the carcass then burnt.

The only articles required for a post-mortem examination are a strong sharp knife (either a " bushman's friend " or a butcher's knife) and a clean bucket of water.

When it is desired to save the hide intact this should be entirely removed before commencing operations.

STAGE 1.

The carcass is laid on its right side and the head and legs extended. The left foreleg is raised and with the knife a cut is made through the skin and tissues of the armpit, between the breast-bone and the limb, and is carried through to sever the connexions of the limb from the chest wall. The leg is gradually raised and cut away from the body. When the skin is not removed, this is now cut backwards from the breast-bone along the middle line of the abdomen between the hind legs as far as the anus. The left hind leg is lifted like the forelimb was, and its muscular connexions inside the thigh are cut through to the hip joint where it can be dislocated and turned right over. The skin remaining on the left side of the trunk is now dissected backwards to the spine.

STAGE 2.—OPENING THE ABDOMEN AND CHEST.

An incision is made behind the border of the last rib on the left side, extending from the spine to the breast-bone, cutting through all the coverings, but taking care not to injure the abdominal contents (intestines, etc.), which often lie close up. A similar incision is made backwards along the spine from the last rib to the bony pelvis behind. The abdominal covering can then be drawn downwards, exposing all organs in the natural position. The chest cavity is now opened by cutting through the left ribs close to their junction with the breast-bone. This is easiest done by hitting the knife with a piece of wood, care being taken not to injure the underlying organs with the point of the knife. The diaphragm or septum between the chest and abdomen is now severed close to the ribs and these latter are drawn upwards and backwards, breaking them at their connexion with the backbone.

By following this procedure all visible organs are exposed in their natural position, and can be viewed collectively.

STAGE 3.—REMOVAL AND EXAMINATION OF THE ORGANS.

The abdominal organs are removed in the following order :

The spleen will be found on the left side and attached to the stomach, close to the diaphragm. Examine its size, colour, consistency and appearance when cut.

The gullet (œsophagus) as it joins the stomach, coming through the diaphragm, is seized with the left hand and severed close in front of the hand, taking care not to allow any of the stomach contents to escape. Without releasing hold of the gullet, the stomach and intestines are now pulled and dissected downwards towards the right-hand leg, all their connexions with the trunk being severed without, if possible, puncturing the intestines.

Very little cutting is necessary, and care should be taken to leave the liver and kidneys within the body.

In all animals the alimentary tract is divided into mouth, gullet, stomach, small intestines and large intestines. In all species the last two named are each divided by anatomists into three sections, of which about twelve inches of the former is known as the duodenum. The portion following this up to the junction of the cæcum is known as the jejunum and ileum, and the very last portion of the large gut is termed the rectum. The portion lying between the cæcum and the rectum is the large intestine.

In the horse, pig and dog the stomach is single, but in the ruminants there are four divisions, of which the last only is a true digestive organ, the others being reservoirs used in connexion with rumination. The third stomach frequently attracts attention as the cause of sickness, but it requires much practice to distinguish between a normal organ, altered only by the amount or character of food eaten within the last twenty-four hours, and a genuinely diseased organ. It is always a hard, firm body, closely packed with skin-like leaves, between which the food passes into the fourth stomach for digestion, and its lining not infrequently peels off when food is extracted from it, especially if the animal has been dead for some time.

The True Stomach and Duodenum.—The contents should be well examined for the presence of worms (many of which are very small), or other parasites; for blood, stones, hair-balls, etc. It is then washed in water, and the condition of the inner lining or mucous membrane can be seen. This is normally of a delicate pink colour.

The Intestines.—The cæcum, or blind gut, which is a pouch-like appendage about the middle of the length of the intestines, is similarly opened up, together with the last piece of the small bowel (ileum), and the character of the contents noted. It is also washed so as to reveal the condition of the mucous membrane. The rectum, or last part of the bowel, is similarly treated. (It is this organ which is damaged by malicious herd-boys thrusting sticks up the anus.) If one wishes to be accurate, the whole bowel should be slit up, but as a rule those parts mentioned show the most important changes.

The kidneys are next removed, and cut in two, and their closely applied capsule or envelope stripped off. They are washed and examined for white spots, or infarcts, and other abnormalities.

The liver is next removed, cut into, and its gall-bladder opened up to show its condition. Size, colour and consistency of the organ should be noted. There is no gall-bladder in equines. Too much attention is, as a rule, devoted to the size of the gall-bladder which in nature varies according to the work thrown upon it, being more distended when active digestion is not taking place, as in the case of an animal which has been off feed for some days. The colour of the bile is normally green in all grass-eating animals; in flesh-feeders, as

dogs and pigs, it is reddish. Grass-feeders also manifest red-coloured bile when they are consuming their own flesh as in long illness and wasting diseases.

The urinary bladder should be opened up and the condition of the urine noted, together with that of the inner lining of the organ. The uterus lies immediately above the urinary bladder and should be opened to observe the state of pregnancy and the condition of the fœtus and its envelopes.

Thoracic or Chest Cavity.—When opening the chest cavity one should observe whether the lungs are adhering to the ribs, whether there is a large amount of fluid in the cavity or whether the inner surfaces of the ribs are inflamed.

The left lung is removed by cutting its attachments, and the wind-pipe, as it enters this organ, is slit up to observe abnormalities.

The Lungs.—These should always be felt between the fingers to prove the presence or absence of nodules or abscesses. A condition known as emphysema may exist where the feel is like that of crackling paper and bubbles or air are seen under the cover of the lungs. Oedema is a condition rather common in horse-sickness, East Coast fever and heart-water, in which the " veins " running in the substance of the lungs appear full of fluid and the wind-pipe and its branches contain froth. If the emphysema or œdema be extensive, the lungs appear to be too big for the chest cavity. In true pneumonia the affected portion of the lung will sink in water and when cut through has the consistency and appearance of a piece of liver.

The Heart.—The heart or pericardial sac is next incised, and the presence of excessive fluid and the condition of the lining is noted. The heart is removed by cutting the large arteries and veins at its base. It is washed and carefully examined, since it is the seat of many small but important lesions. The presence of " bruises " usually indicates a disease of the blood-poisoning category.

The right lung is then removed as was the left. The mouth, tongue, throat and wind-pipe are all observed by removing the skin from under the neck and along the jaw and by pulling and dissecting the wind-pipe downwards and towards the mouth and removing them *in toto* from back to front. This should always be done in a post-mortem examination, as many changes may be found in these organs.

Lymphatic Glands.—The glands are examined and the one lying in the tissue a little above and in front of the left shoulder may be taken as a sample, but those which lie in the mesentery or " apron " which supports the bowels should also be examined. They are cut and their condition noted.

Blood.—The blood is sometimes dark and tarry looking, or it may be thin and watery. A note of its condition should also be made.

If the above-mentioned method of making a post-mortem examination be accurately carried out it is possible always to observe the usual abnormalities which occur in diseases.

A full description on these lines ought to be sent when submitting specimens for examination or when advice is needed.

PART III.

Miscellaneous.

ON THE USE OF SERA AND VACCINES IN THE TREATMENT OR PREVENTION OF DISEASE.

Sera are prepared from the blood serum of animals strongly immune to the disease against which it is utilised, and contain an excess of " anti " substances which are given to the animal inoculated so enabling it for a transitory and variable period to ward off or check the disease microbe which attacks while the anti-substances are still present.

The immunity conferred by anti-serum is passive, that is to say, the inoculated animal takes no active part in its production, and as such is most variable in its intensity and duration. It is in order to avoid this variability and to convert the unsatisfactory passive into a more stable active immunity that in veterinary practice an injection of the virulent microbe is sometimes given simultaneously with the anti-serum. This principle is employed in the active immunisation against rinderpest, for example. Vaccines are prepared from the microbes themselves, which are either killed or attenuated or are injected into a part of the body where the full disease-producing powers cannot be exercised.

Attenuated or modified microbes are commonly utilised for preventive vaccination, the degree of active immunity conferred being in inverse ratio to the degree of attenuation. This method is employed in anthrax, bluetongue, pleuro-pneumonia, etc., as well as in some human diseases.

With two such variable factors as virulence of microbes and individual susceptibility of animals, due to age, breed or environment, it is often a matter of great difficulty to strike the medium that will immunise without killing or producing too severe a reaction.

Killed microbes are sometimes used for preventive vaccination, but in veterinary practice are chiefly employed as curative substances. The explanation of their utility is that the normal protective agents of the body are stimulated by the dead organisms to such a degree that they acquire the property of attacking and destroying the living organisms causing the disease.

Sera and vaccines are invariably specific, that is to say, should the disease be due to microbe "A," a serum or a vaccine against any other microbe than "A" will be inefficacious. So intimate is their relationship that sometimes different strains of the same microbe will be differently acted upon by the anti-substances.

It will be apparent that very close and intimate research is frequently necessary to determine the microbe concerned and to prepare a suitable antidote, and universal success cannot be anticipated for a long time. The use of sera and vaccines requires special knowledge, and their employment ought not to be regarded as a routine measure which is safe and certain in the hands of everybody. Each case should be weighed individually by a veterinary officer, who alone is well versed in the idiosyncrasies of the substance employed.

The following general rules are given as guides to the employment of sera and vaccines.

1. All syringes should be capable of being taken apart for cleaning.

2. The accuracy of capacity and measurements marked on the barrel or piston-rod should be tested, especially in small syringes used for vaccine inoculations, where even a slight error may give rise to serious results.

3. Syringes should be sterilized immediately before use.

4. When large numbers of inoculations are being made, the syringe should be sterilized several times during the operation. Extra sterile needles should always be available and repeatedly changed.

5. After use, the syringe should be sterilized again and dried before being put away, and the needles cleaned with the wires provided in most outfits.

6. When sterilizing a syringe, take the instrument to pieces and lay each part separately on a cloth or pad of cotton wool at the bottom of a saucepan or dish containing sufficient cold water to cover them. Place on the stove or fire, boil for at least five minutes, and then allow to cool. Pour off the water and assemble the syringe, taking care not to touch the inside of the barrel, the piston or the points of the needles. After assembling, ascertain that the adjustments of the syringe are perfect, and that no leaks occur. This may be determined as follows : Suck up into the syringe by means of the piston

some of the boiled water, and eject it once or twice. If after sucking up the water the barrel of the syringe is not completely filled, the screw at the base of the piston needs tightening, but if the piston works too tightly the screw may be slightly loosened.

THE DISEASES OF ANIMALS ORDINANCE.

The following extracts from the Rules under the Diseases of Animals Ordinance, together with scale of veterinary fees and charges for laboratory products, are included for general information :—

" RULE 57. (5) Orders for the supply of laboratory products and payment therefor shall be effected in manner following :—

(a) If the order be communicated by letter a money order or cheque covering the cost of the supplies shall accompany the letter.

(b) If the order be communicated by telegram, the sender shall state therein how payment has been made, and also the amount of such payment.

(c) Payment under the last preceding rule may be effected in either of the following ways :—

   (i) A deposit in either cash or cheque covering the cost may be made at the offices of Senior Commissioners, District Commissioners, Assistant District Commissioners or the nearest Railway Station Master.

   (ii) By money order or cheque forwarded by the first available post after despatch of the order by telegram :

      Provided always that the Chief Veterinary Officer may exercise his discretion as to supplying laboratory products before payment has been made as provided by these Rules if in his opinion the health of the stock of other owners is menaced and there are good reasons why payment has not been made as hereinbefore provided.

(d) When inoculation with laboratory products is carried out by a member of the veterinary staff, the fees must be paid in either cash, notes or cheque to the officer concerned before commencing the operation.

(e) The fees payable for laboratory products shall be as prescribed in the Schedule annexed.

(6) No liability shall attach to the Government or any officer thereof in respect of any loss or damage which may be suffered as a result of any of the services or the use of any of the products mentioned in Schedule A hereto."

SCHEDULE A.

Scale of Fees.

	Per head Sh. cts.
Testing with mallein or tuberculin (imported animals)	10 00
Double inoculation against rinderpest, including treatment with trypanblau (bovine) when necessary, and branding " A.M."	2 50
Double inoculation against rinderpest of unweaned calves, including treatment with trypanblau (bovine), when necessary, without branding ...	1 00
Testing immunity to rinderpest and branding " A.M."	1 00
Testing immunity to bovine pleuro-pneumonia and branding " M.P." with a numeral	2 00
Dipping—	
Cattles, horses and mules	0 10
Calves, sheep and goats	0 05
Testing immunity to East Coast fever and branding " T "	10 00
East Coast fever inoculation—	
Minimum fee for the inoculation of a herd (any number from 1 up to 80 head), including the preliminary redwater and anaplasmosis vaccination	400 00
East Coast fever inoculation for all animals in excess of 80 head, including the preliminary redwater and anaplasmosis vaccinations ...	5 00

Quarantine Fees.

	Per head, per day. Sh. cts.
Horses, mules and donkeys, without food, not exceeding	2 00
Horses, mules and donkeys, with food, not exceeding	3 00
Cattle, without food, not exceeding	1 50

	Per head per day.
	Sh. cts.
Cattle, with food, not exceeding	2 00
Sheep and goats, not exceeding	0 50
Pigs, not exceeding	0 75
A.—Dogs not exceeding Sh. 1/25 per day—	
1. Wire-haired terriers, sealyhams, etc.	0 75
2. Pointers, bull terriers, airedales, etc.	1 00
3. Great Danes, borzois, etc.	1 25
B.—Bitch with litter of pups, not exceeding Sh. 1/50 per day—	
1. Wire-haired terriers, sealyhams, etc.	1 00
2. Pointers, bull terriers, airedales, etc.	1 25
3. Great Danes, borzois, etc.	1 50

(*Note*.—After puppies are weaned the fees charged for them will be those shown under Scale A 1.)

C.—Cats, not exceeding	0 75
D.—Cat with kittens, not exceeding	1 00

(*Note*.—After kittens are weaned the fees charged for them will be those shown under Scale C.)

Laboratory Products.

	Price.
	Sh. cts.
Anti-rinderpest serum, per 50 c.c. (bottles of 250 c.c. each)	2 00
Anthrax vaccine (double), per dose (ampoules of 10 c.c., 20 c.c. and 40 c.c.)	0 30
Bluetongue vaccine, per dose (ampoules of 10 c.c., 20 c.c. and 40 c.c.)	0 05
Colon bacillosis vaccine, per dose (bottles of 1 and 2 doses each)	0 30
Quarter evil (blackquarter) vaccine, per dose	0 20
Redwater and anaplasmosis vaccine, per dose ...	1 00
Sterile trypanblau (canine), per dose (tubes of 1 dose each)	1 00
Sterile trypanblau (bovine), per dose (tubes of 1 dose each)	2 00
Wireworm remedy, per tin of 100 doses	1 00
Dosing spoons for wireworm remedy, per set of 5 ...	7 50

	Price.	
	Sh.	cts.
Dosing spoons, each	1	50
Dosing bowls, each	1	00
Sheep pox vaccine, per dose	0	05
Inoculating needles for sheep pox vaccine, each ...	1	25
Vaccinating instruments for fowl pox vaccine ...	2	50
Fowl typhoid vaccine (Kikuyu fowl disease), per dose (minimum charge for consignment, Sh. 2)	0	10
Fowl typhoid, vaccination of birds at laboratory, including keep per bird (minimum charge per consignment, Sh. 3)	1	00

Quantities usually made up in bottles or ampoules.

Pleuro-pneumonia, contagious abortion, fowl pox, para-typhoid, and ulcerative lymphangitis vaccines are, at present, issued free of charge.

Anti-rinderpest serum shall be exchangeable free of charge only after a period of twelve months and before a period of eighteen months has elapsed from the date of its manufacture as indicated on the container in which it is supplied. No other laboratory products are exchanged on account of age.

APPENDIX.

Native Names of Acute Diseases Affecting Cattle.

We are indebted to many administrative officers and others for the list of appended synonyms employed by the various native tribes throughout the country.

We would, however, warn stockowners not to place too much reliability on the native's diagnosis, and in all cases to confirm this before accepting it as correct.

From our own experience, a number of natives, particularly those of the pastoral tribes, are very quick to distinguish a few well-known diseases, but when symptoms or post-mortem lesions of these deviate in any degree from normal the native is at once puzzled, and may with much assumed confidence give the name of an entirely different condition.

Nevertheless, the following list is included in this pamphlet, in the hope that it may be of some use to those who are wont to place reliance on native opinion in the matter.

NATIVE NAMES OF ACUTE DISEASES AFFECTING CATTLE.

ENGLISH NAME.	MASAI.	LUMBWA.	NANDI.	ELGEO.	WAKIKUYU.	WAKAMBA.
Rinderpest	Oludwa	Kipkaita	Kipkaita	Cheptigon	Muhuruo Nyongo	Ulaia Numama
East Coast Fever	Endigana Ol'Tigana	Chepuonik	Kiptigonet	Isit	Ngai	Ngai
Contagious Bovine Pluero Pneumonia	Ol'Kipiei Ol'Olaras	Kibwonet Chepwonik	Chebwonit	Chebwon	Makori Gashenga	Mabui
Anthrax	Enderit Engeya Nairoua Engujir Omburuo Ol'Engojit	Burasta	Burasta	Teret	Muhumburu Kahoriro	Ndulu
Blackquarter	Engeyaemuny	Kusto	Kipkusta	Chamwagun	Moriro	Ikenni
Redwater	Nakorisho En-Akorisho	Kuseret	Sasoito	Sok	Ndigana	Mutumbo
Contagious Abortion	Gaibern Keiburuo Embenek	..	Sutonik	Sukton	..	Kurrina
Trypanosomiasis	En'Darobo	..	..	Sosoi	Muhari	Moyo
Foot and Mouth Disease						

NATIVE NAMES OF ACUTE DISEASES AFFECTING CATTLE.—(*Contd.*)

ENGLISH NAME.	WAMERO.	KAVIRONDO.	KISII.	SWAHILI.	SOMALI.	KAMASIA.
Rinderpest	Kibei	Obwao Nyabalo	Ongonga	Sotoka	Madohaya Mudobea	Kipkaita
East Coast Fever..	Ita	Aginga Suumde Amabumba	Kavera	..	Bokloxh	Eset or Cheptigonit
Contagious Bovine Pleuro Pneumonia..	Mulimo-Mauri	Amadzokho	..	..	Sumbub-Farckli Sambab	Chebuonit
Anthrax	Thita	Yamo Miyaga	Nthira	Mbenga	Kud	Burasta
Blackquarter	Kibweo	Achem Abach Shibwabo	Nekinama	..	Bashash Habas	Tertit or Koroita-pkusta
Redwater..	Ndurutu	Aremo Indwasi	..	Mkojo Mweusi	Hardig Dikow	Sosoito
Contagious Abortion	..	..	..	..	Diis Gaindhi	Suktonik
Trypanosomiasis	..	..	..	Madudu	Gendi	Sasoik
Foot and Mouth Disease	..	..	..	..	..	Maigutiet

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