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ON A FORM OF SWINE FEVER OCCURRING IN
BRITISH EAST AFRICA (KENYA COLONY).¹

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I. OCCURRENCE.

THE diagnosis of what is herein termed East African swine fever dates from June 1910. Prior to that time the occurrence of swine fever had been officially recorded on four farms in British East Africa, on two of which the history and mortality indicated the existence of this same infection; on the other two there is good reason to believe that a contagious pneumonia associated with bowel lesions, presenting analogies with the European type of disease, was present. On one of these two latter farms a second similar epidemic, which did not appear to be due to a filterable virus, occurred in 1911.

The distribution throughout the Protectorate is, considering the range of farms and the number of pig owners, wide; and it may here be remarked that in every case the presence of wild pig, chiefly the wart hog (*Phacochoerus*), which has a wide distribution, is known in the vicinity of farms on which infection has been diagnosed.

There was at the time of detection but small internal traffic in pigs; the majority of landowners kept a few for their own use, or

¹ This Report was drafted in 1917 from the Records at the Veterinary Pathological Laboratory, Nairobi, of the work carried out there from 1900 to that date. Publication has been delayed owing to the lack of opportunity for revision, caused first by the war and subsequently by the writer's transfer to new activities in South Africa, and later in Uganda. The present incompleteness is realised; but, as no immediate prospect exists of a continuation of this research by the present writer, it is felt that issue should be no longer postponed.

in order to supply a bacon factory, to which their animals are sent by rail. There do not yet exist any central marts, the travelling castrator is unknown, and in no recorded instance could the movement of domestic pigs or of attendants be in any way incriminated. Each outbreak appears to have arisen independently. All domestic pigs now in the Protectorate were originally imported from overseas. There are none indigenous to the country or in the possession of natives in British East Africa.

Farms or holdings are mostly large and unfenced, ranging from 640 acres to many square miles in area, and it was at one time the prevailing custom to ranch the animals, allowing free liberty over a portion of the holding for grazing in charge of native herdsmen, returning the pigs at night to a fenced yard in which food was given and the animals safeguarded from attacks by wild animals.

The mortality from this disease among domestic pigs is so high that the question of "carriers" among them, quite apart from the individual history of each outbreak, does not yet need consideration.

The wart hog (*Phacochærus*) is very common in many parts of the colony. Epidemics of sickness have been recorded in them, notably by parties interested in outbreaks in domestic pigs. We are greatly indebted to many settlers for assistance given in the capture of young wart hog for experimental purposes, but it is to be regretted that so few have lived in captivity sufficiently long to enable any complete positive evidence of its influence to be collected. Further, despite the known occurrence of dead pig, we have as yet been unable to obtain specimens of blood or other substances suited to experimentation. The case against the wart-hog is therefore largely circumstantial, but it is in every way supported by the experimental and epidemiological evidence obtained.

With a greater degree of closer settlement, the destruction of vermin, and the adoption of more care in preventing undue wandering of domestic pigs, chiefly by the erection of "pig-proof" paddocks, the incidence of the disease has been considerably reduced.

It still remains a menace to the pig-breeding industry, for, as available statistics show, an owner, should his herd contract infection, must be prepared for a practically total loss if the immediate eradication of the affected be not undertaken; but the greater care and the precautions now being exercised beneficially show that under the conditions at present existing the disease is one which can in large measure be avoided.

Up to December 1915 fifteen outbreaks were recorded in British East Africa, of which three were proved experimentally to be due to the virus about to be described; in two others corroborative evidence as to the identity of the infection was obtained by testing pigs which had survived and had acquired a certain degree of tolerance. In the remaining ten outbreaks the evidence adduced by the respective owners leaves no room for questioning the nature of the disease. The total number of pigs involved was 1366, of which 1352 or 98.9 per cent, died.

The Chief Veterinary Officer of then German East Africa, in a letter dated 10th July 1914, states that two outbreaks of swine fever had occurred in that country, which "according to investigation

point to the East African form of the disease. The same disease had been noticed among wild pigs, and is probably spread by them." No other particulars have since been obtainable.

Recorded Outbreaks, Course, and Mortality.

<i>Serial.</i>	<i>Date.</i>	<i>District.</i>	<i>Number of Pigs on Premises.</i>	<i>Number of Pigs which Died.</i>
1	1909 September . . .	Thika . . .	90	90
2	1910 January . . .	" . . .	132	132
3	" June . . .	Nairobi . . .	174	173
4	" " . . .	" . . .	150	150
5	1911 March . . .	Thika . . .	15	15
6	" May . . .	Gilgil . . .	120	120
7	" June . . .	Kedong . . .	15	15
8	" July . . .	Gilgil . . .	185	185
9	" " . . .	Njoro . . .	60	54
10	" " . . .	" . . .	40	34
11	" " . . .	Rongai . . .	70	69
12	1912 March . . .	Kedong . . .	30	30
13	" June . . .	Naivasha . . .	240	240
14	" July . . .	Ruiru . . .	30	30
15	" September . . .	" . . .	15	15
		Total . . .	1366	1352 = 98.9%.

II. CLINICAL SYMPTOMS.

Extracting from the reports of veterinary officers and owners and supplementing this by personal observation, it may be said that the onset is invariably sudden.

The affected animal stands with head depressed and tail pendant; the flanks are empty. When moved there is seen to be extreme weakness of the loins, and twenty-four hours after the onset of symptoms a pig has great difficulty in walking. Co-ordination of the fore limbs remains, but the hind quarters sway involuntarily, and in many cases the hind legs are dragged as in paresis.

The temperature is always elevated—104° or over, and it may exceed 107° up to within twelve hours of death, when it suddenly drops to normal or subnormal. Food is refused, but there is extreme desire for water, which is drunk ravenously, and when possible the sick pigs endeavour to lie in it. Diarrhœa is very rarely shown: in the majority of cases fæces are firmer than normal, show adhesions of mucus, and are sometimes streaked with blood. In the light-coloured pigs cyanosis of the ears and thighs is first observed; later the whole body becomes involved. As very few white pigs are bred in East Africa this is not a symptom to attract the owner's attention. Death almost invariably occurs within forty-eight hours of symptoms being detected, often with convulsions, though in a few instances a

state of coma supervenes which may last an additional twenty-four hours.

In some cases the epizootic is ushered in by apparently sudden deaths.

There does not exist evidence to demonstrate that any age or breed, or either sex, possesses a resistance. Experimentally all classes of domestic pigs have been shown equally susceptible.

On autopsy especial attention is directed to the following six principal changes:—

Stomach.—Mucosa of the villous portion deeply congested: more commonly of dark claret colour with hæmorrhagic foci.

Spleen.—About double the normal size: thickened, dark, and firm. Capsular petechiæ present.

Kidneys.—Subcapsular hæmorrhages very common, the whole organ being mottled.

Heart.—Marked ecchymoses on and in left ventricle.

Lungs.—Interlobular œdema in about 50 per cent. of the cases.

Lymphatic System.—Glands hyperplastic and hæmorrhagic.

III. EXPERIMENTAL DISEASE.

(1) *Clinical.*

Of the domestic animals the pig alone appears susceptible.

The majority of our experiments have been carried out with young pigs of three to five months of age, but no variation has been noted in the course in older animals. Recently weaned pigs have been utilised, but no young sucking pigs. All pigs in this Protectorate have originated from overseas, the dominant breeds and crosses being Berkshire, Longblack, Tamworth, and Seychelles. Owing, it is said, to the sun, it is rare to see or obtain white pigs. No variation in susceptibility has been observed in these breeds.

Following upon subcutaneous inoculation with virus, the temperature usually rises on or before the fourth day. The reaction from 104° to 107° F. lasts two to five days, and falls suddenly to death. A few cases have been noted in which no thermal reaction occurred: these were rare, and most commonly followed the injection with aged virus.

About the second day of reaction the pig appears slightly dull, manifests some inappetence, and lies in the bedding. A desire for water remains. A day later extreme depression is common, and when disturbed inco-ordination of the hind limbs is apparent. Diarrhœa is exceptional.

The inoculated disease follows a strikingly uniform course. [*Vide* Charts I. and II.]

In over 200 records of experimental animals the average period of incubation was approximately three and a half days, and duration of reaction four days, death occurring on the eighth day. The extremes of duration were five days (with no or a modified temperature reaction only) and fourteen days (two cases).

When infection has been induced by contact the period of incubation is lengthened by one to three days, but the reaction, duration of disease, and *post-mortem* appearances are identical.

Post-mortem Appearances.—The uniformity of these would appear to be as constant in the natural as in the experimental infection, and should present no difficulty to the diagnostician.

Rigor mortis sets in rapidly, and in tropical countries *post-mortem* decomposition commences early.

There are no specific outward signs. The body is empty and usually there is an absence of diarrhœa.

Peritoneal Cavity.—Usually slight excess of fluid.

Spleen.—Markedly enlarged and thickened, stroma indistinct, parenchyma dark, expressible on section but firm, never diffluent.

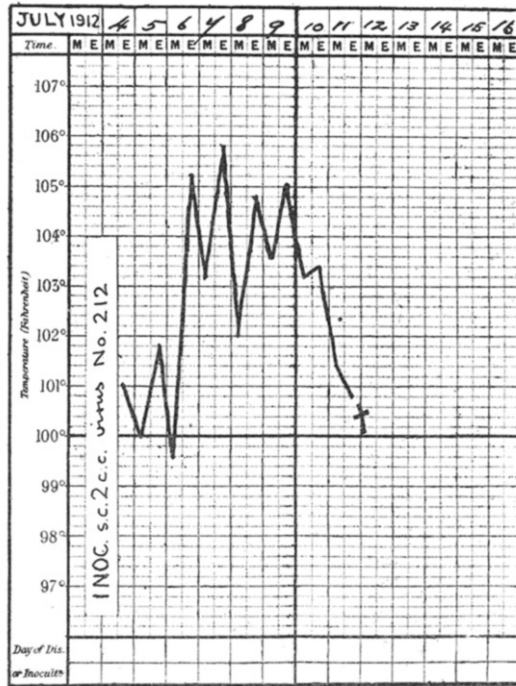


CHART I.

A normal reaction following subcutaneous inoculation of Control Pig 235 with East African virus.

Capsule thin, bluish, and showing venous congestion and frequently petechiæ. The malpighian bodies are prominent. Average size and weight exceeds double the normal.

Stomach.—Contents frequently normal but diminished in amount. Villous mucosa always deeply congested, often hæmorrhagic. Diphtheritic necrosis sometimes present.

Small Intestine.—Contents usually scanty, mucosa throughout œdematous and catarrhal. Solitary and aggregated lymph follicles swollen and sometimes hæmorrhagic.

Large Intestine.—Cæcum commonly distended with fœtid, dark, grumous digesta. Mucosa slightly œdematous and showing venous

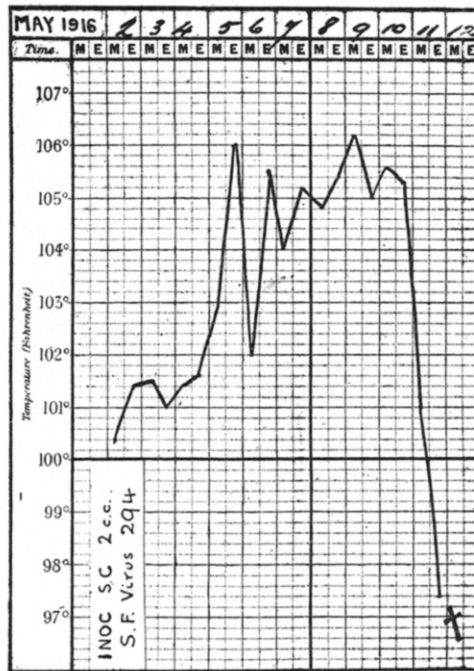
arborescence. In a very few instances discrete points of catarrhal necrosis; the presence of "button" uclers and of diphtheresis is exceptional.

Colon.—Contents scanty, largely mucus; mucosa thickened, very rarely congested.

Rectum.—Contents usually firmer than normal; mucosa slightly thickened and frequently showing punctiform hæmorrhages.

Liver.—Commonly congested, thickened, with distended capsule. On section the parenchyma is firm and uniformly red.

Gall Bladder.—Full of green, fluid, but slightly thickened bile.



Trachea often containing froth. Mucosa injected.
Lymphatic Glands universally swollen, soft, and commonly markedly hæmorrhagic, especially in the lumbar system.

(2) *Animals Susceptible.*

(A) *Experiments with Domestic Animals.*

Experiment 103.—29th March 1911:—

Calf 193	Inoculated 30 cc.	} Filtrate through Cham-berland candle of defibrinated and septic blood of Pig 66, dilution 1:20.
Sheep 141	" 20 cc.	
Dog 11	" 10 cc.	
Rabbit 10	" 5 cc.	
Control Pig 54	" 10 cc.	

Result.—Control pig reacted normally, and died of East African swine fever on the seventh day. No reaction was manifested by the other animals.

Experiment 308.—2nd September 1912:—

Oxen 1292	Inoculated 100 cc. subcut.	} Mixed virus 225 and 260.
" 1304	" 100 cc. intraven.	
Sheep 392 and 525	" 20 cc. "	
" 390 and 534	" 20 cc. intraper.	
Control Pig 252	" 2 cc. subcut.	

Result.—Control pig died of East African swine fever on the eleventh day. No reaction occurred in the other animals.

(B) *Experiments with Bush Pigs (Potomochærus).*

The following experiments were made with wild Bush pig caught for the District Commissioner, Jinja, Uganda, who very kindly sent a number to the laboratory at such intervals as permitted of the adult survivors being gradually domesticated and brought on to experiment in from six to nine months after receipt.

Experiment 91.—18th July 1914. Wild Pig 20 (*Potomochærus* sp.?) obtained from Jinja, Uganda. Inoculated subcutaneously with 1 cc. preserved virus 253.

Control Pig 384 inoculated with same virus on 8th September 1914 reacted and died on the seventh day.

Result.—There was no reaction in Wild Pig 20, which was re-inoculated on the 27th July 1914 with 5 cc. of same virus. No reaction, and no symptoms followed, but the animal died on the twenty-fourth day after reinoculation. The autopsy showed a slight gastro-enteritis of unknown origin.

Experiment 108.—4th August 1914. Wild Pig 22 (*Potomochærus* sp.?) obtained from Jinja, Uganda. Inoculated subcutaneously with 10 cc. prepared virus 254.

Control Pig 379 inoculated with 2 cc. virus 254 at same time.

Result.—Control pig died of East African swine fever on the fifth day.

Wild Pig 22 manifested neither temperature reaction nor symptoms, and was discontinued to another experiment forty-three days after inoculation. It was, however, demonstrated that its blood harboured the virus on the sixth day following inoculation.

Experiment 123.—24th August 1914. Wild Pigs 24 and 25 (*Potomochærus* sp.?) obtained from Jinja, Uganda. Inoculated subcutaneously each with 5 cc. preserved virus 254.

Control Pig 384 inoculated with same virus on 8th September 1914.

Result.—The control died of East African swine fever on the seventh day.

Wild Pigs 24 and 25 showed no reaction, and were discontinued to other experiments on the thirty-third day after inoculation.

Experiment 558.—19th July 1915. Wild Pigs 53 and 54 (*Potomochærus* sp.?) obtained from Jinja, Uganda. Inoculated subcutaneously each with 5 cc. preserved virus Pig 427.

Control Pig 419 inoculated with 5 cc. similar virus at same time.

Result.—Control Pig 419 died of East African swine fever on the seventh day.

Wild Pigs 53 and 54 showed no reaction, and were hyper-immunised without ill effect with large quantities of virus on the twenty-first day.

In addition to the above experiments with Uganda *Potomochærus*, fifteen other wild pigs obtained from the same source received inoculations with varying amounts of controlled virus without manifesting any outward symptoms or any temperature reactions.

It was, however, shown that the virus could remain temporarily in the system of these pigs, the blood of which reproduced the typical disease in a domestic pig (*vide* p. 190).

(C) *Experiments with Wart-Hogs (Phacocærus).*

Despite the assistance of many farmers, who on several occasions sent young wart hogs to the laboratory, we were unable to conduct any crucial experiments with this pig until September 1916. In the majority of attempts the young newly-caught pigs died before they were sufficiently acclimatised to withstand experimentation; in two instances they succumbed before any result could be anticipated.

The pigs received in August 1916 had been caught when newly born in January 1916, and hand-reared, so that they were accustomed to the presence of people. They were utilised for these experiments eight weeks after their receipt, during which time they became used to the restricted confinement of a sty, to the handling by natives, and to the insertion of a thermometer.

Experiment 860.—11th October 1916. Wart Hog 58 inoculated with 2 cc. virus 475.

Domestic Pig 472 was inoculated as control at the same time, but died on the third day from injury, and Domestic Pig 458 was then used as control with the same virus.

Result.—No. 458 died of East African swine fever on the seventh day.

Wart Hog 58, the normal temperature of which is 97° F. or below, manifested an irregular temperature reaction, reaching 101° from the fifth to the fifteenth day. No other symptoms were manifested, and the animal was alive in January 1917. Blood drawn during the reaction was shown virulent (*vide* p. 190).

14th November 1916. Wart Hog 59, which had been in contact

with Wart Hog 58 and with domestic pigs reacting to inoculation and contact since 11th October 1916, was inoculated with 2 cc. preserved virus of 475. From a normal of about 97° the temperature became elevated to 99° between the fifth and twelfth days, and was thereafter normal to death. The pig fed well and appeared healthy up to the twenty-eighth day, although it gradually lost condition. For two days prior to death, which occurred on the thirtieth day, the animal refused food and was semicomatose. The fæces were normal, and no specific symptoms were detectable.

On *post-mortem* there was found a croupous pneumonia of both lungs. The intestinal tract, spleen, kidneys, and lymphatic system were normal.

Blood collected from this animal during the reaction was shown to contain the virus of East African swine fever (*vide* p. 190), but it is doubtful if the lesions of pneumonia were due to that cause.

(3) *Materials Virulent.*

1. *Blood.*—Experiments have clearly demonstrated that the virus is habitually present in the blood at the time of death and during the temperature reaction, though no particular observations have been made to ascertain the precise time at which the blood becomes virulent. It may be noted that on very rare occasions blood drawn during a reaction has been found to be inert. When this has happened it must, I believe, be ascribed to some error in technique, whereby, perhaps, the preservative solution has not been of correct strength. As a routine procedure fresh blood has been drawn into an equal quantity of oxalate-carbol-glycerine solution (oxalate of potash 5 grms., carbolic acid 5 grms., glycerine 1000 cc., water 1000 cc.), which simultaneously prevents coagulation and preserves the virus. Unless otherwise specified, the term "preserved virus" frequently used in this Report means blood mixed with an equal quantity of this oxalate-carbol-glycerine solution.

2. *Serum.*—For the collection of specimens for demonstrating the infectivity of serum, blood was drawn into flasks provided with a central rod fixed to the bottom, around which the clot formed, and a lateral tubular for decantation or aspiration of the clear fluid. No experiments have been made to corroborate the opinion of the English Committee that the virus is by predelection attached to the red corpuscles.

Enumeration of the experiments made is not indicated, as serum obtained in the method described above has invariably been found virulent; and in other parts of this Report, more especially in the sections on filtration and duration of virulence, specific instances will be found.

3. *Organs.*—In virtue of the virus in the blood, all organs are virulent.

4. *Body Fluids.*—The occurrence of a clear, apparently blood-free fluid in the thoracic, pericardial, and peritoneal cavities is not uncommon on autopsy. In every case this fluid has been found to possess a virulence equal to that of blood.

5. *Urine.*—For the purpose of experiment urine was collected on *post-mortem* by puncturing the bladder through an area cauterised

almost to the point of perforation, and aspirating the contents into a sterile syringe.

Experiment 179.—(a) Pig 86. 4th December 1911. 150 cc. urine of Pig 104, just dead, added to contents of food trough.

Result.—A typical reaction commenced on the fifth day and continued to death from East African swine fever on the tenth.

(b) Pig 135. 4th December 1911. 5 cc. urine of Pig 104, just dead, inoculated subcutaneously.

Result.—The reaction commenced on the second day and lasted to death on the eighth day. Diagnosis, East African swine fever.

Experiment 253.—(a) Pig 213. 11th June 1912. 5 cc. urine of Pig 214, dead four hours, were sprayed into the mouth by means of a syringe.

Result.—The reaction commenced on the fourth day and the animal died of East African swine fever on the seventh day.

(b) Pig 225. 23rd July 1912. Inoculated subcutaneously with 2 cc. urine of Pig 228 four hours after collection.

Result.—Reaction commenced on the third day and lasted to death from East African swine fever on the sixth.

No failure to reproduce the disease with urine freshly procured at autopsy are to be recorded, but with urine of over two days old, and where filtration was attempted, negative results were sometimes obtained.

6. *Fæces.*—In order that adventitious contamination with blood might be avoided, the sphincter was dilated by means of a blunt speculum and the rectal contents expelled per anum into a sterile dish. At least three hours were allowed to elapse from death before fæces were collected, as it was hoped thereby that the coagulation within the submucous capillaries would render rupture and consequent contamination less probable.

Experiment 253.—Pig 220. 11th June 1912. A piece of fæces, measuring about one inch by half an inch diameter, collected four hours after death from Pig 214, which contracted the disease by contact, was dropped into the mouth and partly masticated.

Result.—The reaction commenced on the fourth day and lasted to death from East African swine fever on the seventh.

Pig 221. 22nd June 1912. This animal was fed in an identical manner to Pig 220 (*vide supra*), the fæces having been kept in a Petri dish at room temperature in the dark for eleven days.

Result.—A temperature reaction was manifested on the fourth and fifth days only. The animal died of East African swine fever on the seventh.

Note.—The fæces of Pig 214 (11th June 1912) were not virulent on the twenty-third day.

7. *Bile.*—Experiments with this secretion were variable in result. In three cases no reaction followed inoculation, although bloods collected simultaneously from the same pigs were shown virulent. No protection to subsequent infection by contact was afforded by this bile inoculation.

In three instances positive reactions occurred, ending in death within ten days.

The bile was obtained by aspiration into a syringe, the needle of which punctured a well-cauterised area of the gall bladder.

IV. METHOD OF EXPERIMENTAL INFECTION.

(a) *Inoculation*.—No failure to produce infection has been recorded when virulent material has been inoculated subcutaneously, intramuscularly, intraperitoneally, or intravenously.

Intracutaneous infection, brought about by applying preserved virus to a surface abraded by scarification, succeeded in the one attempt made. No other methods of inoculation were attempted. The routine method consisted in subcutaneous injection over the shoulder.

(b) *Contact*.—No failure has been experienced in inducing infection when susceptible animals have been placed under natural conditions in contact with clinically reacting animals. A pig does not appear to be infective during the first twenty-four hours of temperature reaction, a feature that will be discussed in greater detail later, under "Methods by which Disease is transmitted."

(c) *Infection per os*.—The virulence of urine and fæces taken in by the mouth has already been demonstrated (*vide* "Materials Virulent").

The object of feeding experiments with preserved blood was to establish, if possible, a method of infection less severe than that following subcutaneous inoculation.

Instances exemplifying the uncertainty of this method are given.

Experiment 392.—Pig 300. 2nd July 1913. 1 cc. preserved virus 265 diluted in 5 cc. was syringed into the mouth. Reaction commenced on the sixth day, and lasted to death from East African swine fever on the twelfth.

Pig 301. 2nd July 1913. 1 cc. preserved virus 265 diluted in 5 cc. saline was syringed over the throat. No reaction followed, and the same procedure was followed on 18th July, 1st August, 12th August, 21st August, 1st September, and 16th September without result. On 3rd October precisely the same operation was conducted with the same virus. A reaction commenced on the fifth day and ended in death from East African swine fever on the thirteenth.

Pig 305. 18th July 1913. 1 cc. preserved virus 265 diluted in 5 cc. saline syringed over the throat. A reaction commenced on the night of the fifth day and lasted to death from East African swine fever on the eleventh.

Experiment N19.—Pig 366. 12th April 1914. 1 cc. preserved virus 254 diluted in 5 cc. saline was syringed over the throat. No reaction followed, and the same dose was given on 1st May. On 22nd May 2 cc., on 1st June 5 cc., and on 9th June 10 cc. of the same virus were given in like manner over the throat without any reaction ensuing. On 13th July 1914 this pig was inoculated subcutaneously with 1 cc. of the same preserved virus (No. 254). A reaction commenced on the fourth day and lasted to death from East African swine fever on the eleventh.

Experiments to ascertain whether "Baited" Food could convey the Disease to Susceptible Pigs.

Experiment 473.—In this experiment holes were cut in sweet potatoes (*Ipomæa batatas*) by means of a potato borer, the virus inserted, and the opening closed with a portion of the removed core.

Pigs 355 and 368 each ate infected sweet potatoes as follows:—

23rd December 1913	.	.	.	1 cc. virus 254
7th January 1914	.	.	.	2 cc. „ „
21st „ „	.	.	.	2 cc. „ „
4th February „	.	.	.	2 cc. „ „
18th „ „	.	.	.	2 cc. „ „
4th March „	.	.	.	2 cc. „ „
19th „ „	.	.	.	2 cc. „ „
31st „ „	.	.	.	5 cc. „ „

No reaction followed this feeding.

Virus 254 was shown virulent on subcutaneous inoculations up to September 1914.

Both pigs subsequently contracted East African swine fever by contact and died in August 1914.

Experiment 474.—In this experiment the virus was inserted into bananas (*Musa sapientum*). Fig. 342. A banana, containing on each occasion 2 cc. virus of 254 (1st August 1913), was fed on the same dates as in the above experiment, No. 473. No reaction followed, and the pig died from East African swine fever acquired by contact in August 1914.

V. BACTERIOLOGY.

No micro-organism has been detected in the examination of smears from blood. Sown on the usual culture media under aerobic and anaerobic conditions, no visible growth has resulted.

Bacillus suisepiticus and allied forms have been isolated from the intestinal tract, mesenteric glands, lungs, and mediastinal glands. No results have followed the inoculation or feeding with these bacteria, which are regarded as symbiotic, and responsible only for the diphtheritic, necrotic, and inflammatory lesions sometimes found in the intestinal tract and the lungs, especially of animals in which the reaction was prolonged.

(1) *Virulence of Filtrates.*

Instances of the virulence of filtrates have already been mentioned. It must be stated, however, that failure has occasionally been experienced, possibly due to the use of an imperfectly cleaned candle.

(A) *Berkefeld No. 7.*

Experiment 128.—Pig 76 was bled to death on 24th May 1911. Defibrinated blood, diluted 1:10 in tap water, was passed through a new Berkefeld candle by aspiration at 45 cm. The filtrate was sterile in culture.

Pigs 79 and 80 were each inoculated 30th May 1911 with 10 cc. filtrate (1 cc. virus). The reaction commenced in both cases on the fourth day, No. 79 dying of East African swine fever on the tenth day, and No. 80 on the seventh.

Experiment 100.—Pig 74 was bled to death on 5th June 1911. The serum was separated by clotting, and a dilution of 1:10 in tap water filtered through a Berkefeld candle by aspiration at 45 cm.

The filtrate was sterile in culture, and was tubed into ampoules of 2 cc. capacity.

Pig 243 inoculated on 7th August 1912 with 2 cc. stored serum filtrate of Pig 74, one year and two months old. A reaction commenced on the fifth day and ended in death from East African swine fever on the tenth.

(B) *Chamberland F.*

Experiment 103.—Pig 66 was bled to death on 26th March 1911. The defibrinated blood became contaminated, and caused the death from septicaemia of several animals. This blood diluted in tap water, 1:20, was passed by aspiration at 45 cm. through a new Chamberland F candle. The filtrate was sterile in culture, and on inoculation did not affect animals other than the pig.

Pig 54 inoculated 29th March 1911 with 10 cc. filtrate obtained as above (.5 cc. virus). The reaction commenced on the evening of the third day and ended in death from East African swine fever on the seventh.

(2) *Resistance of Virus. In vitro.*

The present known maxima in each instance are alone quoted. Storage was effected in the dark at room temperature.

(A) *Age.*

1. *Defibrinated Blood kept in Flasks of 30 cc. capacity plugged with cotton wool:*—

Pig 65 inoculated 20th March 1911 with 2 cc. virus as above of Pig 32, collected 1st November 1910, 140 days old. Reaction commenced on the fifth day and ended in death from East African swine fever on the seventh.

2. *Filtrate of Serum kept in sealed ampoules of 2 cc. capacity:*—

Pig 243 inoculated 7th August 1912 with 2 cc. filtered serum (.2 cc. virus) of Pig 74 collected 5th June 1911, 428 days old. Reaction commenced on the fifth day and ended in death from East African swine fever on the tenth.

3. *Blood preserved in equal parts of Oxalate-Carbol-Glycerine:*—

Pig 384 inoculated 8th September 1914 with 2 cc. blood of Pig 254 preserved as above since 1st August 1913, 404 days old. A reaction commenced on the fourth day and lasted to death from East African swine fever on the seventh.

Owing to a temporary cessation of experiments on swine fever there appeared danger of losing the strain. For the sake of economy a composite virus was employed in the following experiment.

Experiment N349—19th January 1915. Pig 397 inoculated subcutaneously with 2 cc. of each of the following viruses preserved in oxalate-carbol-glycerine.

Virus 294	Collected	9th Jan. 1913	740 days old.
„ 248	„	25th Jan. 1913	726 „
„ 288	„	9th Apr. 1913	650 „
„ 265	„	12th May 1913	617 „
„ 254	„	1st Aug. 1913	536 „

An indefinite temperature reaction commenced on the fourth day, symptoms were present on the sixth, and the pig was bled to death on the seventh. Lesions of East African swine fever were present on autopsy. The virus collected has been subsequently employed and reproduced the typical disease.

(B) *Decomposition.*

1. An example of resistance to the presence of putrefactive organisms has been given under "Filtration, Chamberland F., Experiment 103." In that case only three days elapsed between the time of drawing and of inoculation.

2. Pig 159 was inoculated on 31st January 1912 with 45 cc. of 1:20 dilution virus 144 passed through a Berkefeld candle (2.25 virus). This virus had been collected without any precautions by cutting the pig's throat over a dish containing a solution of citrate; it was transferred to a washed but not sterilised bottle, corked, and left on the laboratory bench for sixteen days. Considerable gas had developed in the bottle, and the odour of putrefaction was most pronounced. The filtrate was sterile in culture.

Result.—A reaction commenced on the third day and lasted to death from East African swine fever on the sixth.

3. An ampoule containing the unfiltered serum of Pig 74, collected on 5th June 1911, was forwarded to England on 10th August 1911. Under date of 27th September 1911, Sir Stewart Stockman reported, ". . . the virus was very putrid when it arrived, and, although my experience has been contrary to Uhlenhuth's in that I have found that putrefaction does not destroy the virus of swine fever, there is, of course, a limit."

I take the liberty of quoting from the Departmental Committee's Report the result obtained in London with the above putrid virus of Pig 74.

"Pig 2090. On 19th September 1911 this pig received subcutaneously 7 cc. . . . A temperature reaction followed up to 105° F. on the third day. The animal became very ill and died on the 28th September, *i.e.*, the ninth day after inoculation."

The lesions were those of East African swine fever, and this animal, Pig 2090, served as a source of virus for the continuation of the work carried out by Sir Stewart Stockman for the Departmental Committee on swine fever.

(C) *Drying.*

In the following experiments the serum was dried over sulphuric acid in a dessicator.

(a) *At Room Temperature for Forty Days.*

Experiment 204.—19th January 1912. Pig 82 inoculated subcutaneously with .25 dried serum of Pig 88 (died 9th December 1911) dissolved in saline. No reaction followed.

5th February 1912. Pig 82 re-inoculated with .45 gramme of the same dried serum. No reaction.

5th February 1912. Pig 160 inoculated subcutaneously with .45 gramme of the same serum dissolved in saline. No reaction followed.

(b) At 37° C. for 134 Hours.

Experiment 194.—20th December 1911. Pig 126 inoculated subcutaneously with 3 grammes serum of Pig 88 dried in vacuo at 37° C. for 184 hours. A temperature reaction commenced on the fourth day and lasted to death from East African swine fever on the seventh.

*(D) Effect of Heat.**(1) At 37° C.*

Experiment 191.—Pig 140 inoculated 16th December 1911 with 2 cc. preserved blood of Pig 88 maintained in the incubator at 37° C. for 104½ hours. A reaction commenced on the evening of the third day and the pig died of East African swine fever on the sixth.

Pig 143 inoculated 2nd January 1912 with 2 cc. preserved blood of Pig 88 maintained in the incubator at 37° C. for 528 hours (twenty-two days).

A faint but noticeable reaction lasting three days commenced on the third day after inoculation. Pig 143 was subsequently tested for immunity by placing in contact with the disease, and died of East African swine fever in March 1912.

Note.—The unheated virus of Pig 88 was shown virulent subsequent to the above experiment.

(2) At 40° C.

Experiment 305.—Pigs 280 and 283 inoculated 30th August 1912 each with 3 cc. preserved virus 260 kept at 40° C. for fifteen days.

No. 283 reacted on the evening of the fifth day and died of East African swine fever associated with a diphtheritic catarrh in the cæcum on the tenth day.

No. 280, which lived in contact with the above, did not react until the eighth day. This reaction lasted five days, when the temperature returned to normal for two days. The pig died on the night of the fifteenth day. On autopsy the catarrhal and necrotic diphtheresis of the alimentary tract and the absence of a markedly enlarged spleen indicated a modification in virulence.

Pig 274 inoculated 9th September 1912 with 3 cc. preserved virus of 260 kept at 40° C. for twenty-five days. No reaction. Re-inoculated 21st September with 20 cc of the same virus kept at 40° C. for thirty-seven days. No reaction.

The susceptibility of Pig 274 was demonstrated in April 1913.

Note.—The unheated virus 260 was shown virulent up to 11th January 1913.

(3) At 50° C.

Seventeen pigs inoculated with preserved virus from various animals which had been heated for fifteen and thirty minutes, one, two, and three hours at 50° C., were inoculated in various experiments. All these contracted the normal disease. When heated for four hours the results were more variable.

Three and a Half Hours.

Experiment 292.—Pigs 262 and 271 inoculated 15th August 1912 with 4 cc. preserved virus 260, heated at 50° C. for three and a half

hours. In both cases the reaction commenced on the sixth day and lasted to death from East African swine fever, associated with slight cæcal diphtheresis, on the eleventh and tenth days respectively.

Four Hours.

Experiment 292.—Pigs 246 and 253 inoculated 15th August 1912 with 4 cc. preserved virus 260, heated at 50° C. for four hours. The reaction commenced suddenly on the fifth day and continued to death from East African swine fever, associated with gastric and cæcal diphtheresis, on the thirteenth and eleventh days.

Experiment 273.—Pigs 254 and 258 inoculated 18th July 1912 with 2 cc. preserved virus 212, heated at 50° C. for four hours. A faint but evident reaction commenced on the fourteenth and twelfth days respectively and lasted to the twenty-fourth and twenty-third days. No symptoms were shown and the animals continued normal. No immunity resulted, both pigs dying on subsequent inoculation tests.

Control Pig 228 inoculated at the same time with 2 cc. unheated preserved virus 212 died of typical East African swine fever on the fourth day, and its blood was proved to be virulent.

(4) *At 55° C.*

(a) *Heating for Two Hours.*

Experiment 219.—Pig 136 inoculated 27th February 1912 with 5 cc. serum 105, heated for two hours at 55° C. No reaction. The pig died a year later without having been tested.

Control Pig 141 inoculated at the same time with unheated serum 105 died of East African swine fever on the seventh day.

Experiment 272.—Pigs 239 and 241 inoculated 18th July 1912 each with 2 cc. preserved virus 212 (2nd June 1912), heated for two hours at 55° C. A mild but evident reaction occurred between the tenth and twenty-first and the fifteenth and twenty-first days respectively, but no symptoms were shown and the animals continued normal.

No. 239 died in March 1913 of East African swine fever as a result of subsequent inoculation with virus heated at 55° C. for ten minutes, and No. 241 died from a contact infection experiment in February 1913.

Control Pig 228 inoculated at the same time with 2 cc. unheated virus 212 died of a typical East African swine fever on the fourth day.

Experiment 299.—Pigs 198, 236, 237, and 240 inoculated 16th August 1912 each with 3 cc preserved virus 260, heated at 55° C. for two hours. No reaction followed. All pigs subsequently underwent further inoculation with virus heated at 55° C. for varying periods, with the object of conferring immunity.

No. 236 died of East African swine fever; No. 198 was eventually found to be immune; Nos. 237 and 240 eventually died with lesions resembling English swine fever which followed subsequent inoculations.

Control Pig 252 inoculated at the same time with 3 cc. unheated virus 260 died of East African swine fever on the tenth day.

(b) Heating for One Hour.

Experiment 219.—Pig 137 inoculated 27th February 1912 with 5 cc. serum 105, heated for one hour at 55° C. No reaction followed. Pig 137 died in August 1912 without having been tested for immunity.

Control Pig 141 inoculated at the same time with unheated serum 105 died of East African swine fever on the seventh day.

Experiment 272.—Pigs 242 and 244 inoculated 18th June 1912 each with 2 cc. preserved virus 212, heated for one hour at 55° C. In both cases a slight but evident reaction occurred between the tenth and twenty-fourth day, but no symptoms were shown and the animals continued normal.

Both pigs subsequently died from East African swine fever, No. 242 in January 1913 as the result of a virulent inoculation; No. 244 in April 1913 following an inoculation with virus heated to 55° C. for fifteen minutes.

Control Pig 228 inoculated at the same time with 2 cc. unheated virus 212 died of swine fever on the fourth day.

Experiment 299.—Pigs 238, 264, 198, 236, 237, and 240 inoculated 30th August 1912 each with 3 cc. preserved virus 250, heated to 55° C. for one hour.

Pig 236 showed a marked reaction from the fifth day to death from East African swine fever on the night of the tenth day. It was removed from contact with the others on the sixth day.

No reaction whatsoever followed the inoculation in the other five pigs. The infection of No. 236 is believed to have been accidental.

The unheated virus of Pig 260 was shown virulent up to 11th January 1913.

(c) Heating for Thirty Minutes.

Experiment 299.—Pigs 250 and 270 inoculated 16th August 1912 each with 3 cc. preserved virus 260, heated to 55° C. for thirty minutes. No reaction followed. Both pigs subsequently contracted East African swine fever and died the following month.

Pigs 198, 237, and 240 inoculated 13th September 1912 each with 2 cc. preserved virus 260, heated to 55° C. for thirty minutes.

No reaction followed in No. 198, which was eventually shown to be immune to East African swine fever. No. 240 manifested a definite though rather faint reaction from the seventh to the thirteenth days; no symptoms were shown. No. 237 died on the twentieth day, the temperature having risen from the ninth in a gradual line to 105° F. on the eighteenth day. On autopsy an acute fibrinous pleurisy and pericarditis were revealed; the spleen was swollen, and the cæcum contained fifteen raised "button" ulcers indicative of the European form of swine fever. *Bacillus suissepticus* was obtained in culture from the spleen and pleura. No experiments were made with blood of this pig, but other animals which had lived in contact did not contract a similar infection. It is therefore believed that death was not due to swine fever.

Pigs 273 and 275 inoculated 3rd December 1912 each with 2 cc. preserved virus 260, heated at 55° C. for thirty minutes. No reaction followed. Both pigs subsequently died of East African swine fever.

The unheated virus of 260 was shown virulent up to 11th January 1913.

The following five pigs were inoculated each with 2 cc. preserved virus 294, heated at 55° C. for thirty minutes: Nos. 244 and 274 on 21st February 1913, Nos. 81 and 85 on 17th April 1913, and No. 268 on 2nd May 1913. There was no reaction in any of the above pigs.

Unheated virus 294 was shown virulent in a Control Pig 265 on 2nd May 1913.

(d) *Heating for Twenty Minutes.*

Experiment 299.—Pigs 198 and 240 inoculated 12th October 1912 and Nos. 275 and 293 inoculated 30th December 1912 each with 2 cc. preserved virus 260, heated at 55° C. for twenty minutes.

A faint reaction followed in Pig 240 lasting for five days, after which the animal continued normal. Pig 275 remained normal for twenty-two days. A reaction commenced on the twenty-third day and continued to death from East African swine fever associated with pneumonia of both lungs and gastric and duodenal diphtheresis on the thirteenth day. It is considered that this reaction was due to accidental infection and bore no relationship to the injection made a month previous to death.

Unheated preserved virus 260 was shown virulent on 11th January 1913.

(e) *Heating for Fifteen Minutes.*

The results obtained by heating virus at 55° C. for fifteen minutes are in strong contrast with those seen when the heating is continued for five or more minutes longer.

In order that this comparison may be more clear a reference is made to such experiments performed on the same day and with the same virus.

It is firmly believed that accidental infection did not enter into the positive results, which were in most instances controlled by the negative effects in animals receiving the same virus which had been heated for longer periods, and that reactions are due solely to the inoculations.

It will be observed that in two cases animals which manifested a resistance to one inoculation died as the result of a second with the same virus. A further instance of irregularity of heat at 55° C. for fifteen minutes is observable in the case of heated virus 294, which appeared non-virulent on 13th March and 5th June 1913, although it killed Pig 224 on 1st April 1913.

Another feature in the results obtained from these experiments is the high proportion in which the incubative period and the reactions were prolonged to a type more resembling that of the more subacute European form.

Autopsy on these animals, too, showed in many cases lesions more comparable with the European than with the East African variety.

Experiment on 16th August 1912.—Virus 260. (Compare results of heating this virus at 55° for two hours, one hour, and for thirty minutes.) Pigs 249 and 269 inoculated 16th August 1912 each with 3 cc. preserved virus 260, heated at 55° C. for fifteen minutes.

In both cases a reaction commenced on the eleventh, rising suddenly in No. 269, and lasting to death on the eighteenth day. In No. 249 the rise was gradual and fell to normal for two days prior to death on the twentieth day. Autopsy revealed the lesions of East African swine fever, associated in No. 269 with diphtheritic necrosis of the gastric mucosa.

Experiment on 30th August 1912.—Virus 260. (Compare results of heating the virus at 55° for one hour and for thirty minutes.) Pigs 250, 270, 281, and 284 inoculated 30th August 1912 each with 2 cc. preserved virus 260, heated at 55° for fifteen minutes.

No 281 reacted on the sixth and died on the eighth day. No. 284 reacted on the fifth and died on the twelfth day. Autopsy in both showed the lesions of East African swine fever, associated with broncho-pneumonia and in No. 284 the presence of diphtheritic necrosis in the cæcum. Pigs 250 and 270 showed no reaction; these had previously received one injection with virus heated at 55° C. for thirty minutes. They died when reinoculated with heated virus.

Experiment on 13th September 1912.—Virus 260. (Compare result of heating the virus at 55° C. for thirty minutes.) Pigs 250 and 270 each inoculated with 5 cc., and Nos. 238, 256, and 264 each inoculated with 2 cc. preserved virus 260 (29th July 1912), heated at 55° C. for fifteen minutes.

No. 270 reacted on the sixth day, and died on the tenth from East African swine fever, associated with numerous centres of diphtheritic necrosis in the cæcum. No. 250 possibly contracted the disease by contact with No. 270; the reaction in this commenced on the eleventh day and lasted to death from East African swine fever on the eighteenth. No diphtheritic lesions were seen on *post-mortem*. These pigs had previously withstood a similar injection. Nos. 238, 256, and 264 reacted on the eighth, fifth, and sixth days respectively, and died on the fourteenth, thirteenth, and sixteenth. In addition to typical lesions of East African swine fever, each of these pigs showed slight diphtheritic catarrhal changes in the large bowel, and in one a typical "button" ulcer 1 ccm. in diameter and numerous smaller foci were present.

Experiment on 2nd November 1912.—Virus 260. Pigs 198, 240, and 285 inoculated each with 2 cc. preserved virus 260, heated at 55° C. for fifteen minutes.

There was no reaction in No. 198, which was eventually shown to be immune. No. 285 reacted on the ninth day and died on the seventeenth with lesions of East African swine fever, accompanied by pneumonic areas in both lungs and areas of diphtheritic deposit in the cæcum. No. 240 reacted on the thirteenth day, the temperature curve falling to death on the twenty-ninth day. On autopsy the lesions of East African swine fever were restricted to subcapsular petechiation of the kidneys (also found in the European type) and rectum. Broncho-pneumonia and pleurisy were present in both lungs, and the cæcum and colon showed a large number of "button" ulcers. *Bacillus suissepticus* was obtained from the lungs. This pig had been the subject of several previous injections with virus heated at 55° C.

Experiment on 3rd December 1912.—Virus 260. (Compare heating

at 55° C. for thirty minutes.) Pig 289 inoculated with 2 cc. preserved virus 260, heated at 55° C. for fifteen minutes.

After two days of indefinite temperature a definite reaction commenced on the ninth day and lasted to death on the fourteenth. The lesions present on autopsy were those of East African swine fever, accompanied by large areas of diphtheritic necrosis in the stomach, and small foci of diphtheritic deposit in the large bowel.

Experiment on 24th January 1913.—Virus 260. Pigs 273 and 293 inoculated each with 2 cc. preserved virus 260, heated at 55° for fifteen minutes.

A reaction ensued on the sixth and seventh days and the pigs died on the thirteenth and seventeenth days respectively. The lesions present were those of typical East African swine fever, associated with pleurisy in No. 273.

Experiment on 1st April 1913.—Virus 294. Pig 244 inoculated with 2 cc. preserved virus 294, heated at 55° for fifteen minutes.

A reaction commenced on the seventh day and lasted to death from East African swine fever on the fourteenth.

Experiment on 2nd July 1913.—Virus 265. Pigs 81 and 85 inoculated each with 10 cc., and Pigs 251, 254, and 268 inoculated each with 2 cc. preserved virus 265, heated at 55° C. for fifteen minutes.

No. 85 reacted on the seventh and died from East African swine fever associated with intestinal diphtheresis on the tenth day. No. 81 did not react until the twelfth day (possibly by contact with No. 85), and died on the eighteenth from East African swine fever. Nos. 251 and 268 reacted on the seventh and died on the eleventh and twelfth days respectively. The lesions were those of East African swine fever. No. 254 did not react until the twenty-eighth day, and it was bled to death two days later. It is considered that this was a case of accidental infection and that the inoculation of 2nd July was not directly responsible for the reaction.

(f) *Heating for Ten Minutes.*

Pig 239 inoculated 24th January 1913 with 2 cc. preserved virus 260, heated at 55° C. for ten minutes. No reaction followed.

Note.—This virus heated at 55° for fifteen minutes on the same day proved virulent in Pigs 273 and 293. This pig was reinoculated on 21st February 1913 with 2 cc. preserved virus 294, heated at 55° C. for ten minutes. A reaction commenced on the fifth day and continued to death from East African swine fever on the twelfth.

Pigs 94 and 274 inoculated 1st April 1913 each with 10 cc. preserved blood 294, heated at 55° C. for ten minutes.

No. 94 reacted on the seventh day, and died of East African swine fever on the thirteenth. No. 274 showed no reaction to this inoculation, but succumbed later to an injection with the same virus heated at 55° C. for five minutes.

(g) *Heating for Five Minutes.*

Pig 274 inoculated 17th April 1913 with 2 cc. preserved virus 294 heated at 55° C. for five minutes.

A reaction commenced on the sixth day and terminated in death on the twelfth. The *post-mortem* examination showed the presence

of lesions of the East African type together with areas of broncho-pneumonia in both lungs, diphtheresis of the gastric mucosa, and numerous typical "button" ulcers in the cæcum. This pig had previously received several inoculations with virus heated at 40° and 55° for varying periods.

Pig 91 inoculated 5th June 1913 with 2 cc. preserved virus 294, heated at 55° C. for five minutes.

A reaction commenced on the fourth day and ended in death from East African swine fever on the seventh.

(5) *At 60° C.*

Virus proved to be virulent prior to heating has been retained at the above temperature for periods varying from four hours in the initial tests (made before other temperatures were used) down to ten minutes. A total number of sixty-five inoculations with such heated virus were made, all with negative results. In some cases attempts were made to induce immunity from the repeated injection of virus heated for decreasing lengths of time. No immunity appeared to be established.

The following experiment indicates the destructive action of heat at 60° C.

Experiment 265.—12th July 1912:—

Pigs 198, 236, 237, and 240 inoculated each with 2 cc. virus 212, heated at 60° C. for twenty minutes.

Pigs 248, 251, 255, and 256 inoculated each with 2 cc. virus 212, heated at 60° C. for fifteen minutes.

Pigs 259, 265, 268, and 273 inoculated each with 2 cc. virus 212, heated at 60° C. for ten minutes.

No reaction whatsoever ensued.

Unheated virus 212 was shown virulent on 18th July 1912.

VI. METHODS BY WHICH THE DISEASE MAY BE TRANSMITTED
IN NATURE.

(1) *Direct Contact between Living Pigs.*

In the course of the experimental work numerous observations have demonstrated that an association with a clinically reacting pig, if only for a few hours, is sufficient to induce infection in a susceptible animal. It is necessary to state that the infecting animal must be sufficiently advanced in reaction for some clinical evidence of disease to be apparent, for, as will be seen below, a contact between healthy susceptible pigs and those still in the early stages of thermal reaction may be without effect.

The following may be taken as a typical example of contact infection. Other instances will be found throughout the Report.

Experiments 9, 10, 11.—14th September 1910. Pig 22 inoculated with 1 cc. of a 1:10 dilution of splenic pulp filtered by aspiration through Chamberland F candle (1 cc. virus). Pig 23 inoculated with 1 cc. of a 1:10 dilution of serum filtered by aspiration through Chamberland F candle (1 cc. virus). Pigs 24, 25, and 26 were placed in contact.

Result.—No. 22 reacted on the third day and was bled to death on the sixth. No. 23 reacted on the night of the fourth day and died on the night of the ninth. No. 24 reacted on the night of the eighth day and died on the thirteenth. No. 25 reacted on the tenth and died on the fourteenth. No. 26 reacted on the tenth and was bled to death, when *in extremis*, on the fifteenth.

It has been stated that no particular observations have been made to ascertain the precise time at which the virus becomes generalised in the blood. It has, however, been noted on several occasions that a pig may not be infective by contact during the twelve or twenty-four hours of thermal reaction.

During some of the earlier experiments, more particularly in reference to transmission of the disease through the air, accidental infection occurred in one pig of a styre containing two or three. This was manifested by a high temperature reaction, and in some doubtful cases the animal remained in contact with the others for a further twelve or even twenty-four hours until the reaction was confirmed. Infection did not spread to the in-contact animals when the reactors were then removed to isolation tanks. It is believed that these isolated infections sometimes resulted from the careless use of contaminated thermometers.

Attention is drawn to this point as representing, in some cases, a method by which an owner might save his stock of pigs at the commencement of an outbreak.

The following specific instances may be cited:—

(a) In the course of Experiment 149, Pigs 106 and 113 had lived in a clean house from 25th September 1911. On the 25th October 1911 the temperature of Pig 106 was two degrees above this animal's previous normal. On the following day it registered 105° in the morning and 106.4° in the evening, and it was then removed to an isolation tank, where death from East African swine fever occurred on the 30th October. Pig 113 remained in the same house, which was in no way clean or disturbed, up to 29th December 1911 without contracting infection.

(b) During Experiment 212, Pigs 156 and 157 were placed in a clean house on 5th February 1912. On the evening of 18th February 1912 No. 156 showed a temperature of 106.4° . The following morning, the same degree being recorded, the pig was removed to an isolation tank, where he died of East African swine fever on 22nd February. Pig 157 manifested no reaction until inoculated with urine on 27th February 1912, when a normal response followed, ending in death on 6th March.

Contact *per se*, that is to the exclusion of infection per os, is apparently harmless. Muzzled pigs have lived in association with the disease for much longer periods than unmuzzled animals. This question is discussed more fully later.

(2) *Duration of Infectivity of Styres.*

In the course of other experiments it was indicated that infection very quickly disappeared from a styre or isolation tank, and in view of the importance from the point of view of an owner who wishes to restock, and from the standpoint of veterinary administration, crucial experiments were made.

In this connection it should be noted that in Experiment 253 (p. 168) faeces kept in a Petri dish at room temperature but in the dark were virulent eleven days after collection.

The sun in East Africa is undoubtedly a powerful disinfectant, and the virus in excreta maintained under natural conditions would in all probability become killed in less time than that indicated by the above-mentioned experiment.

The experiments about to be described were carried out in a styre constructed of faced and squared stone blocks built in lime mortar and pointed with cement, the floor being of the same material. One half of the building was roofed with corrugated iron, and the yard was open to the weather. A wall provided with a doorway separated the two portions.

The building was rough, and provided ample lodging places for virus. Throughout each experiment all food stuffs, litter, and dung were left *in situ*; only the bodies of dead pigs were removed, and no cleaning was attempted. The litter was hay.

Experiment 187.—8th December 1911. Pig 147 was inoculated on this date with 5 cc. preserved virus 119 (24th September 1911), and Pigs 145 and 146 were placed in contact in the styre. To avoid accidental infection no temperatures were taken.

No. 147 died on the ninth day after inoculation.

No. 145 " " thirteenth day after contact with No. 147.

No. 146 " " fifteenth " " "

On 18th December, that is ten days after the inception of the experiment, five new pigs were placed in the styre in order to contract infection by contact.

No. 151 died fifteen days after exposure to the styre.

No. 152 " nineteen " " "

No. 153 " sixteen " " "

No. 154 " " " " "

No. 155 " " " " "

Pig 152, the last of the seven contacts, died on 6th January 1912 at 10.30 A.M.

Ten days later, 16th January 1912, the styre having been left untouched, Pigs 63, 139, 142, and 143 were put in. No reaction occurred during the fifty-four days the animals remained under observation in that styre. These pigs were subsequently shown susceptible.

Experiment 354.—11th January 1913. Pig 242 was inoculated with virus 260 (29th July 1912), and placed in a styre in company with Nos. 248 and 286 as contact controls.

No. 242 died on the ninth day.

No. 248 was bled to death on the fourteenth day (25th Jan.).

No. 286 died on the fourteenth day.

Three days after the deaths of Nos. 248 and 286, Nos. 241 and 259 were placed in the styre, which had remained untouched.

No. 241 died on the twelfth day.

No. 259 " " eighteenth day.

Experiment 224.—13th March 1912. Pigs 63 and 139, 142 and 143, which were used in Experiment 187 (*vide ante*), together with Pigs 183, 184, and 185, were placed in a styre, and Pig 165 reacting to East African swine fever was placed in contact. This animal

died three hours later, but the body was left in contact until the morning—fifteen hours after inclusion.

No. 63 died on the eleventh day.
 No. 139 „ „ seventeenth day.
 No. 143 „ „ fourteenth day.
 No. 142 „ „ twentieth day.
 No. 183 „ „ eleventh day.
 No. 184 „ „ nineteenth day.
 No. 185 „ „ fifteenth day.

In addition to these animals, No. 196, inoculated on 18th March, was included in the sty, and died there on 27th March, the fourteenth day after the experiment was instituted.

No. 142, the last animal to die, succumbed during the night of the 31st March.

Five and a half days later, *i.e.*, on the morning of the 6th April, Pigs 198 and 199 were put into the sty, which had remained untouched since the death of No. 142.

There was no reaction for sixty-two days, when No. 199 died of broncho-pneumonia. No. 198 was subsequently found to be immune.

Experiment 354.—Pig 259 died during the night of 15th February. On 21st February, or five days and a half later, Pigs 265 and 268 were put into the sty, which had not been touched.

No reaction followed during sixty days of observation, after which both pigs were shown susceptible to East African swine fever.

(3) *Contact after Death.*

Under conditions of nature it is not probable that wild pigs come by day so close to the homestead that the domestic pigs have an opportunity of such intimate contact as would appear to be necessary for transmission. They may, however, pass over the ground during the night, and fæces or even dead bodies may be left. The omniverous habits of swine would cause either of these to be eaten greedily, and, infection per os being demonstrated, it is necessary to ascertain whether the virus can live in the blood after death, and whether such a body is infective by contact.

Experiment 1.—20th August 1910. Pig 14 died in Nairobi during the night of 19th August. The body was carried to the laboratory, and at 4 P.M., roughly fourteen hours after death, 10 cc. of clotted blood was withdrawn from the heart. At that time decomposition was marked. Pig 15 was inoculated subcutaneously with this blood. There was no local disturbance to indicate sepsis, but the temperature rose the following day and remained elevated (105°) to death from East African swine fever on the sixth day.

A subsequent experiment with blood taken sixty-four hours after death was made, but the carcass being very decomposed the blood washings were filtered through a Berkefeld. No reaction followed inoculation with 60 cc., equivalent to about 1 cc. of virus. The failure may have been due either to decomposition or to an uncontrolled filter.

Experiment 225.—7th March 1912. Pig 157 died of East African swine fever at 3 P.M. on 7th March. Two hours later the body was placed in a clean isolation tank. At 8 A.M. the following morning,

that is, seventeen hours after death, Pigs 165 and 166 were placed in the same tank in contact with the dead body, which was allowed to remain there for a further thirty-six hours. These two pigs reacted on the fifth day, and died of East African swine fever on the sixth and ninth days respectively.

It was noted that as a result of *post-mortem* distension both urine and a small quantity of fæces was expelled from the body of 157 subsequent to being placed in the tank, and that the anus and root of the tail were eaten by Pigs 165 and 166 during the thirty-six hours' contact.

(4) *Virulence of Discharges taken per os.*

When discussing under that heading the "Materials virulent," it was shown that urine recently drawn from the bladder at autopsy was capable of producing the disease when sprayed into the mouth with a syringe, or when added to the food. Failure was sometimes experienced when the urine was more than two days old.

Feeding with fæces obtained on autopsy also resulted in infection, in one instance even when the specimen had been kept at room temperature in the dark for eleven days.

It must be added that we experienced some failures to reproduce disease by feeding with fæces, but the positive instances quoted were sufficiently controlled to justify an opinion that under certain circumstances both urine and fæces may be virulent and capable of infecting animals by ingestion.

Experiments to be detailed subsequently indicate most forcibly that the virus of East African swine fever does not pass through the air, and that pigs, if muzzled, can live in direct contact with diseased animals without contracting infection. It is, therefore, difficult to believe that this form of swine fever is capable of natural transmission in any way except through the mouth, and to effect this a recent contamination of substances eaten would seem necessary.

(5) *Passage of Virus through the Air.*

In order to ascertain to what degree and distance, if any, the virus of East African swine fever can travel as an infecting agent through the air, a small portable house was constructed consisting of two insect-proof compartments, each 4 feet by 4 feet, between which passed a free current of air, interrupted only by wire mosquito gauze. The sides were of closely-set jointed boards, the sliding door and drawer-like food boxes being so arranged that attendants upon each compartment, called "A" and "B," could approach from different directions without coming into contact or using the same path. The front and back were of mosquito gauze protected by wooden slots.

The centrally-placed wire gauze partition which separated the compartments was guarded at a distance of 6 inches within each by strips of wood placed 6 inches apart, the object being to permit of pigs, in both A and B, pushing their noses as closely as possible towards each other without being able to tear the wire.

The floor was covered with sheet lead, which was continued up the sides for a distance of 6 inches in order to make each compartment self-contained for drainage. The floor at the centre of

the house was 3 inches higher than at the front and back, so ensuring an outward gravitation of excrement. To reduce the possibility of direct contamination should the guard rails and the lead-lined skirting of each compartment not preclude the ejection of urine by sows from one compartment to the other, only male pigs were utilised in these experiments.

A European exercised an observant control over the natives in charge of each compartment, and prevented any contact between them. Each attendant and the food for each compartment came from centres over a mile distant, where healthy control animals were simultaneously being looked after. Separate thermometers for each compartment were kept.

Experiment 149.—19th August 1911. Pig 106 was placed in one half of the Experimental House (Compartment A) on 19th August 1911, and Pig 101 in what was to become the infected compartment (B). The building was arranged so that the prevailing wind blew through B into A. At the site selected an almost continuous breeze occurred, and with very rare exceptions this came from the east.

No infection having resulted, and the house and the methods adopted having been shown free from infection, Pigs 101 and 121 (Compartment B) were inoculated on 4th September 1911 with virus 74. A reaction occurred on the night of the third day, and both pigs died on the fifth day (9th September 1911) following inoculation.

Three days later, 12th September 1911, Pig 106 (Compartment A) still remaining healthy, Pig 124 was inoculated with filtered virus No. 101 (9th September 1911) and placed in Compartment B together with Pig 119, which served as a direct contact control. No. 106 remained in A as an indirect air control. No. 124 reacted on the fourth day, and died on the sixth (18th September 1911). No. 119 in direct contact, reacted on the tenth day after contact with No. 124 (or six days after that animal manifested a rise in temperature) and was bled to death two days later (24th September 1911).

The following day (25th September 1911) Pig 115 was inoculated with virus of Pig 119 and put into the infected compartment B, together with Pig 87 as a direct contact control. No. 106 continued healthy in A, and a second healthy pig, No. 113, was included in that clean compartment. No. 115 reacted on the second day and died during the night of the fifth. No. 87 reacted on the ninth day after inclusion and died on the sixteenth (11th October 1911) from East African swine fever.

Immediately on the death of No. 87, Pig 89 was put into the infected house. A reaction commenced on the fifth day, and the pig died of East African swine fever on the twelfth (23rd October 1911).

Pigs 106 and 113 remained normal to 24th October, forty-seven days after the introduction of infection to B, but on the following day No. 106 manifested a temperature, and was removed to an isolation tank on 26th October, where it died of East African swine fever on 30th October. The method of infection is not known, but is considered as possibly due to the use of a contaminated thermometer.

The other air contact animal, No. 113, remained healthy and did not contract infection in Compartment A.

On 22nd November Pig 122, which was reacting to inoculation with virus 119, was put in Compartment B in direct contact with Nos. 104 and 123. Pig 113 still remained in indirect air contact in A.

No. 122 died four days later (26th November 1911). No. 104 reacted on the sixth day and No. 123 on the seventh day, and both died on the twelfth day (4th December 1911) after exposure to No. 122.

Pig 88, inoculated on 4th December 1911 with blood taken from No. 104 immediately at death, was put in Compartment B. Marked reaction occurred, and the animal was bled to death five days later (9th December 1911), the blood being shown virulent in subsequent experiments.

Pig 113 continued healthy in Compartment A and remained there until 30th December 1911, twenty-one days after the death of the last infected animal in B (Pig 88), when the experiment was discontinued.

Experiment 212.—5th February 1912. This experiment was undertaken to control and confirm the result obtained in the previous observation. The conditions of experiment remained the same.

Result.—Of two animals, Nos. 156 and 157, placed in A (indirect air contact), on 5th February, one, No. 156, contracted infection thirteen days later, possibly through a thermometer. The second, although subjected to the same conditions, resisted up to the twenty-second day, when it was removed, inoculated as a control, and transferred to the infected B Compartment.

A second series of two pigs was placed in Compartment A on 1st March, and the animals remained healthy until the experiment was discontinued on 12th June, *i.e.*, 104 days. During this time fourteen pigs died of East African swine fever in Compartment B, of which six were direct contact controls which contracted infection with the usual regularity and died, four in six days and two in five.

Effect on Muzzled Pigs in Contact with Disease.

Experiment 174.—1st November 1911. This experiment had for its objects: (1) the control of results to be obtained from the indirect air infection experiments already detailed, the muzzled animals being placed in intimate contact; and (2) to note, in the event of positive results being obtained, the influence of such parasites as lice and fleas, both of which occurred freely on the pigs in the compartment.

The muzzle consisted of a long galvanised iron cup of conical shape, the bottom of which was composed of stout wire gauze so recessed within the cup that intentional or accidental grovelling by the wearer would fail to permit of contaminated material gaining contact with the mouth. The muzzle was held in position by straps.

Muzzled animals remained in contact with the affected for a period of twelve hours, being then transferred to an isolation tank for feeding after the removal of the muzzle. As a precaution against

accidental infection their feet were washed in creolin solution before liberation.

Pig 179 was muzzled, and from 1st March 1912 spent the twelve hours of night in the infected B Compartment of the house already described. On the thirty-first day, during which period seven of his unmuzzled contact companions had died of swine fever, this animal developed a reaction to the disease, from which he succumbed five days later. The cause of the infection was probably accidental.

Pig 203 was muzzled from the 10th April 1912, and spent the twelve hours of day in the infected compartment. No reaction was manifested, but the pig died suddenly on 4th May. There were no lesions of swine fever on autopsy. During the twenty-two days contact three unmuzzled companion pigs had contracted the disease by contact and died.

Pig 206 was muzzled, and from 4th May 1912 spent the twelve hours of night in the Compartment B. The experiment was concluded on the 12th June, during which thirty-eight days four unmuzzled contact pigs contracted and died of swine fever. No. 206 was found susceptible when subsequently tested.

(6) *Transmission by Fleas and Lice.*

The species of the parasites with which experiments were conducted have not yet been identified.

In addition to the experiments with muzzled pigs living in direct contact with infected and lice- and flea-infected pigs, which clearly indicate the non-transmission of disease through their agency, the following experiments were conducted.

The fleas or lice were collected immediately after the death of a pronounced case of East African swine fever, and were at once placed on the body of the subject pig, which was segregated in a clean, galvanised-iron isolation tank.

Lice. Experiment 162.—19th September 1911. Pig 122. Twelve lice collected from the body of No. 124 placed on this animal. There was no reaction during an observation of fifty-six days. Pig 122 died of East African swine fever in November 1911, and was therefore susceptible.

24th September 1911. Pig 123. Forty-five lice collected from the body of Pig 119 were placed on this animal. No reaction followed, and the pig was subsequently proved susceptible.

11th October 1911. Pig 88. Three hundred and forty-three lice collected from the body of No. 87 were placed on this animal. No reaction followed, and the pig was shown susceptible to East African swine fever in December 1911.

Fleas. Experiment 172.—20th October 1911. Pig 104. Twenty fleas collected from Pig 125 placed on this animal. No reaction followed in twenty-six days, and the pig was proved to be susceptible.

(7) *Influence of Animal Reservoirs, especially Wild Pigs.*

In each recorded outbreak of this disease there is an entire absence of any history indicating, even in the slightest degree, that movement of domestic pigs, men, forage or foodstuffs, or any other inert body, could be incriminated for its introduction. The

disease would appear to have arisen spontaneously, and invariably the sickness began in a single animal, and from it spread after a week or so to others, which in turn carried infection to the remainder.

Attention has been drawn to a view commonly held by owners that wild pig are the responsible carriers.

It is necessary to make clear that several species of wild pig occur in this Protectorate, and of these more than one, if external characteristics and markings are evidence, are unnamed. Specific designations are therefore not attempted.

The wart hog (*Phacochoerus*) has received most attention from owners, largely no doubt owing to its partiality for open country, where it is to be seen in families, and also from its wide geographical distribution and the large numbers occurring in some localities.

The Bush pig (*Potamochoerus*) may be taken as a type of the other family, and it is in this that specific classification is extremely difficult. The distribution of some species—chiefly the type—is wide, and it is not infrequently seen in country somewhat covered with scrub and bush. The Forest species is rarely seen, and no data concerning it as a disease carrier are available.

In the owners' evidence concerning two outbreaks the statement is made that "it is no uncommon thing in the Kedong Valley for the wild pig (wart hog) to become subject to outbreaks of disease which kill a certain number of them and cause the remainder temporarily to migrate." While this sickness in the wart hog may be due to East African swine fever, we have not as yet been successful in obtaining from any source blood or other specimen suitable for experimentation, and the diagnosis must remain in abeyance. It is, however, worthy of note that in the course of an epizootic of rinderpest in cattle on the Uasin Gishu Plateau in 1913-14 large numbers of wart hog died, it is believed from rinderpest; certainly no outbreak of swine fever had been recorded from that locality, in which domestic pigs are being bred.

A large mortality is also recorded from Uganda among the Bush pig (*Potamochoerus* sp.?) simultaneously with an epizootic of rinderpest among the cattle. Owing to the valuable assistance of the administrative and veterinary officers at Jinja we have obtained a number of these Bush pigs for experiment, and have also been able to demonstrate that they are susceptible and succumb to rinderpest.

Several landowners have very kindly caught young wart hog and forwarded them to the laboratory, but with few exceptions they died during the train journey or within a few days after arrival. One exception, which had been reared as a pet, died shortly after inoculation and before any conclusive result could be obtained; two others are referred to in detail later.

Very great difficulty was experienced in maintaining these wild pigs in captivity, as, owing to nervousness and disinclination for food, they sulked and died. The Uganda Bush pigs on arrival were liberated in a small wire-fenced paddock in company with others that had been with us for several months. After two or three months' acclimatisation in this paddock they were drafted first to a fenced yard, and then to a sty into which native attendants went in order to feed, and when quite accustomed to

these men they were moved to isolation tanks and there became used to handling and the insertion of a thermometer. Only after these pigs were thoroughly quiet and free from nervousness were they brought on to experiment. Considerable time was spent in these preparations, but a knowledge that premature death was obviated and that the results obtained were reliable fully justified the delay.

In order that swine fever can be carried, it is perhaps not necessary that the host should die. It is obvious that a dead body affords a more certain method of leaving the virus on a farm, but, as already pointed out, it would appear that fæces passed by an infected animal may also retain virulence for a time and be capable of infecting an animal when ingested.

As was mentioned when discussing the animals susceptible to East African swine fever, the Uganda Bush pig and the wart hog do not react to inoculation as do domestic pigs; they manifest no symptoms, and are presumably immune. It would appear, however, that the immunity is not so complete as it is in oxen and sheep, and that the virus can live in the wild pigs' blood for a certain time.

(1) *Domestic Animals.*

Experiment 308.—2nd September 1912:—

Ox 1292 inoculated 100 cc. subcutaneously.

Ox 1304 inoculated 100 cc. intravenously.

Sheep 392 and 535 inoculated each 20 cc. intravenously.

Sheep 390 and 534 inoculated each 20 cc. intraperitoneally.

Control Pig 252 inoculated 2 cc. subcutaneously with mixed preserved virus 225 and 260.

The control pig died of East African swine fever on the eleventh day. There was no reaction in the other animals. Twenty-four hours after the inoculation 100 cc. blood was taken from Ox 1304 and injected subcutaneously into Pig 273; at the same time Sheep 392 and 535 were bled 50 cc. each and the mixed blood injected subcutaneously into Pig 241.

Result.—No reaction whatsoever occurred in Pigs 273 and 241 during an observation of one month.

On the eleventh day after the inoculation Ox 1304 was again bled and 100 cc. were injected subcutaneously into Pig 248; and 100 cc. of blood was taken from Sheep 390 and injected subcutaneously into Pig 244.

Result.—No reaction whatsoever occurred in Pigs 244 and 248 during an observation of six weeks.

(2) *Uganda Potamochoerus (Bush Pig).*

Experiment 108.—4th August 1914. Uganda Bush Pig 22 inoculated subcutaneously with 10 cc., and Control Pig 379 inoculated subcutaneously with 2 cc. preserved virus 254.

The control pig died of East African swine fever on the fifth day. The Bush pig manifested neither temperature reaction nor symptoms.

On the sixth day after inoculation 5 cc. of blood were withdrawn by aspiration from the tail of Bush Pig 22, and were inoculated into Domestic Pig 371, which reacted on the third day and died of East

African swine fever on the fifth, its blood being proved virulent on subinoculation.

(3) *East African Phacochærus (Wart Hog)*.

Two female wart hogs which had been hand reared from within a few hours after birth were purchased from a farmer on the Uasin Gishu, where they had been caught. On arrival at the laboratory in August 1916 they were seven months old.

(a) *To ascertain whether the above wart hogs reared under conditions of freedom from swine fever naturally harbour the virus of swine fever.*

Experiment 850.—11th September 1916. Wart Hogs 58 and 59 were each bled 20 cc., and this blood was inoculated subcutaneously into Domestic Pigs 473 and 475. There was no temperature reaction, and No. 475 was discontinued to another experiment twenty-three days later, and shown susceptible.

No. 473, inoculated from No. 58, died on the twentieth day, cause unknown, without having manifested either reaction or symptoms, and no lesions of swine fever were present on *post-mortem*.

(b) *To note the effect of contact between wart hogs and infected domestic pigs.*

1. 11th October 1916. Wart Hog 59 was placed in contact in a sty with Wart Hog 58 and Domestic Pig 472 (both of which were inoculated with East African virus 475), and with Domestic Pig 474, which was included as a control to contact infection. As No. 472 died of injuries two days later, No. 458 was inoculated in its place with the same virus. No. 458 died of swine fever on the seventh day, and the contact control, No. 474, died two days later from the same cause.

Blood drawn from Wart Hog 58 (inoculated) on the sixth, ninth, thirteenth, and seventeenth days was proved virulent for domestic pigs on inoculation.

Infection was therefore present in the sty in which No. 59 was living, but inoculations made with its blood ten and twenty-three days after the commencement of the experiment were negative, and it was subsequently shown capable of harbouring the virus after an inoculation.

It would appear that Wart Hog 59 did not contract infection by contact with infective Domestic Pigs 458 and 474, and with infective Wart Hog 58.

2. On 21st October 1916, or the tenth day after Wart Hog 58 had been inoculated with virus, and when its blood was proved to be virulent on inoculation, Wart Hogs 58 and 59 were removed from the sty contaminated by the reactions in Domestic Pigs 458 and 474, and were placed in a clean sty. After a lapse of two days, in which it was hoped any infection that was on their skins and feet might have died off, Domestic Pig 461 was placed in contact with them.

The blood of Wart Hog 58 was shown to be infective up to and including 28th October, but the blood of Wart Hog 59 remained negative up to the 2nd November, and Domestic Pig 461 did not contract infection by contact during an observation of forty-five days, during which period Wart Hog 59 was also inoculated and its blood shown infective on subinoculations.

It would appear that Domestic Pig 461 did not contract infection

while living with Wart Hogs 58 and 59, whose blood was proved to be virulent during that time. The susceptibility of No. 461 to East African swine fever was subsequently shown.

(c) *Can wart hogs inoculated with East African swine fever harbour the virus?*

11th October 1916. Wart Hog 58 inoculated subcutaneously with 2 cc. virus 475 freshly collected.

The normal temperature of this pig is 97° F. or below. An irregular temperature reaction reaching 101° F. occurred between the fifth and fifteenth days following inoculation. 25 cc. blood was withdrawn from the tail and added to an equal amount of oxalate-carbol-glycerine preservative on the sixth, ninth, thirteenth, seventeenth, and twenty-first days, and the undernoted inoculations undertaken, each with 5 cc. of the preserved blood (2.5 cc. virus). All inoculated domestic pigs were separately isolated, and the inoculations were so performed that each experiment was controlled by non-reacting pigs which acted as checks to the possibility of accidental contamination.

<i>Days after Inoculation.</i>	<i>Domestic Pig No.</i>	<i>Result.</i>
6	476	Reaction third day; death swine fever eighth day.
9	459	Faint reactions; death swine fever eighth day.
13	462	No reaction; death swine fever eighth day.
17	464	Reaction fifth day; death swine fever tenth day.
21	466	Nil. Under observation twenty-one days.

On the thirty-fourth day Wart Hog 58 was reinoculated with 2 cc. preserved virus 475. A slight temperature reaction occurred on the next day (99.6° F.) and lasted for thirteen days. During this period the pig was bled into preservative on the seventh and thirteenth days after reinoculation, and this blood was injected into Domestic Pig 479 without result.

Wart Hog 58 was alive 103 days after its first inoculation, and it appeared in every way healthy, and its temperature was normal.

Wart Hog 59 had been in contact with swine fever from 11th October 1916. It had been bled on the tenth and twenty-third days after contact and the blood inoculated into Domestic Pigs 460 and 467 without result.

14th November 1916. Wart Hog 59 inoculated subcutaneously with 2 cc. preserved virus 475. The normal temperature of this pig was about 97° F., and from the fifth to the twelfth days after inoculation it was about 99° F. No symptoms were noted until the twenty-eighth day, and the animal died with lesions of pneumonia on the thirtieth day.

The following experiments were made with the blood drawn on different dates:—

<i>Days after Inoculation.</i>	<i>Domestic Pig No.</i>	<i>Result.</i>
6	478	Reaction fifth day; death swine fever ninth day.
11	480	Reaction fifth day; death swine fever eighth day.
15	466	Nil.
18	466	Nil.
24	461	Nil.
24	479	Nil.
30 (at death)	461	Nil.

} Susceptibility of these pigs proved later.

From these experiments it is clear that wild pigs, both Phacochoerus and Potamochoerus, can retain the virus of East African swine fever in their blood for a period after infection by inoculation. This infection did not appear to occur following mere contact with the disease, nor did the infective wild pigs appear capable of disseminating the virus by contact, urine, and fæces.

To what extent these negative results would happen under natural conditions, or if large numbers of wild pig were available for experiment, cannot be foreseen. The carnivorous habits of the wart hog especially are well known, and it may be that in nature infection is spread amongst them by the eating of infective meat, and that the disease enters a domestic herd in the same way.

(To be continued.)

RESEARCHES REGARDING EPIZOOTIC ABORTION OF CATTLE.

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(Continued from p. 126.)

HERD NO. 7.

THE first sample of blood from an animal in this herd was forwarded on the 7th December 1914. It was taken from a cow that had slipped her calf on the previous day, and when tested agglutination was complete in $\frac{1}{2}$, 1, and 2 tubes (1:50, 1:100, and 1:200).

The herd was a large and valuable one, and occasional cases of abortion had previously occurred in it. For some time all aborting cows had been temporarily isolated and thorough disinfection practised. The owner thought it would be difficult or impossible to isolate reacting animals except by putting them into separate boxes on the same premises, but in spite of that he agreed to have a general test of the herd carried out.

Blood from thirty-four animals was accordingly forwarded on