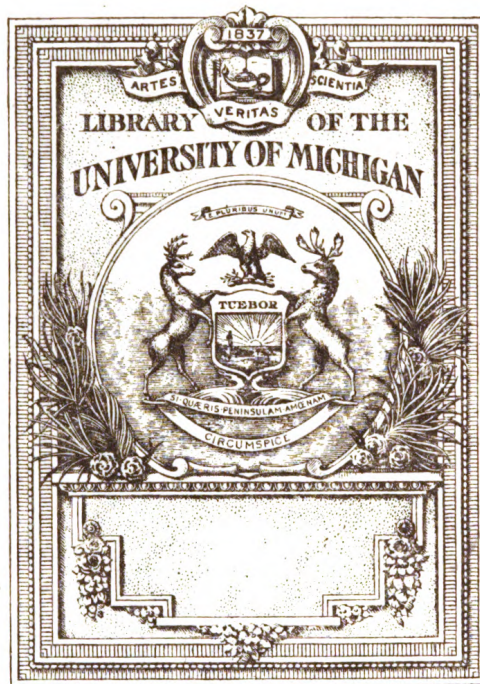


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# TROPICAL VETERINARY BULLETIN

ISSUED UNDER THE DIREC-  
TION OF THE HONORARY  
MANAGING COMMITTEE OF  
THE TROPICAL DISEASES  
BUREAU.



General Editor:  
THE DIRECTOR OF THE BUREAU.

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VOL. 4.  
JANUARY—DECEMBER, 1916.

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pp. 1-49.]

[March 30, 1916.

# TROPICAL VETERINARY BULLETIN

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### Erratum.

No. 4, page 150 (tenth line from foot), *for* "especially in the provinces of Cagliari and Sassari," *read* "but more especially in the province of Cagliari than in the province of Sassari."



TROPICAL DISEASES BUREAU.

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1916.

[No. 1.

BABESIASIS (PIROPLASMOSIS) AND ANAPLASMOSIS.

- (1) CARPANO (M.). Note epizootologiche sulle infezioni piroplasmiche degli equini in Italia. [Equine Piroplasmosis in Italy.]—*Il Moderno Zootatro*. 1915. Oct. 31. Vol. 26. No. 10. pp. 404-412.

Both Nuttalliasis and Babesiasis occur in Italy, but the former is the more common. Occasionally cases of mixed infection are encountered. It would appear that the diseases follow a more benign course in the northern part of the peninsula than in the middle and southern parts, and cases are more frequently seen on low-lying uncultivated land than elsewhere.

According to the author's observations *Nuttallia equi* is transmitted by *Rhipicephalus bursa*, and *Babesia caballi* by *Margaropus annulatus*. The former of these passes the larval and nymphal stages on one host, and transfers itself to another for the adult stage. Ticks may become infected from the first host, and hand on the infection to the second. In the case of *Margaropus annulatus*, on the other hand, all the stages from larva to adult are passed on the same host, and consequently the parasite is handed on to the next animal by ticks hatched out from eggs deposited by an infected female.

Cases of the diseases may arise either as primary attacks or as relapses. The former generally occur during the spring or early summer, but the latter may be observed at all seasons. When a susceptible horse is introduced into an infected area, the period elapsing before the disease makes its appearance is generally 10-20 days. Relapses may occur within a short time after the primary attack, or there may be an interval of some years. They are not as a rule very serious, and seldom terminate fatally.

In apparently recovered animals *Nuttallia equi* persists in the blood for long periods, and should the infected animals become the subject of any debilitating condition a relapse is likely to occur. During the period of latent infection the parasite is said to be present in the blood in a form which resembles *Anaplasma*.

The immunity conferred by an attack or by experimental infection is not an absolute immunity, and it is strictly specific according to the type of parasite responsible for the primary infection.

In the ass and the mule only parasites of the *Nuttallia* type have been found.

- (2) VELU (H.) & EYRAUD (A.). **Observations sur diverses formes de Piroplasmes, rencontrées sur des bovins indigènes de la Chaouia.** [The Various Forms of Piroplasms found in Indigenous Cattle at Chaouia.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 643-646.

On a farm about 25 miles from Casablanca one of the authors saw two animals showing the following symptoms: Loss of appetite and suppression of rumination, pronounced thirst, pale mucous membranes, red urine, diarrhoea, the blood pale in colour and watery. There were numbers of ticks in the ears and the perineal region. One animal had already died after showing a similar train of symptoms.

Although piroplasmosis had only been discovered previously in imported animals, the condition of the animals raised the suspicion that they might be affected.

In blood taken from one of the animals a few hours before death 52 per cent. of the blood corpuscles were found to contain parasites. They were present in the form of long and short rods, comma-shaped organisms, oval, rounded, and amoeboid forms. In many cases a number of parasites were present in the same corpuscle, the largest number seen being five. The great majority of the parasites were very small.

In the blood of another animal, which died a few hours later, the number of parasites found was almost the same as in the first case. In two animals shortly after the onset of symptoms, the percentage of corpuscles invaded was about 30, and it was only exceptionally that more than one parasite was found in a single cell.

The small number of observations that the authors were able to make does not warrant any very definite conclusions. They specially point out that twin pear-forms were very scantily present.

- (3) CRAWLEY (H.). **Note on the Stage of *Piroplasma bigeminum* which occurs in the Cattle Tick, *Margaropus annulatus*.**—*Jl. of Parasitol.* 1915. Dec. Vol. 2. No. 2. pp. 87-92. With 4 text-figs.

The parasite described in this paper was found in some ticks which had been used as controls in some dipping experiments.

They were removed from the cattle, immersed in water, dried, and placed in Petri dishes. Ordinarily such treatment does not cause any unusual behaviour on the part of the tick, but on this occasion a high mortality was observed in certain lots, and microscopic examination of some of them revealed the parasite described in this paper.

The parasites were cigar-shaped, and varied somewhat in length and width. The mean length of 50 specimens taken at random was about 11 microns. The cytoplasm of each was finely alveolar. There was a central vesicular nucleus with a large rounded karyosome. At the more rounded end of the body there was a kind of cap which varied somewhat in appearance in different specimens. In some cases it was rather like a crown with a minute pointed process arising from the central part, and in other cases it was like a narrow shell fitting over the extremity of the parasite. In some specimens the cap appeared to be rather denser and more homogeneous than the rest of the cell.



Analogy is drawn between these parasites and those found by CHRISTOPHERS in *R. sanguineus*, which he considered to be a stage of *P. canis*. Reference is also made to the observations of KOCH, NUTTALL, GRAHAM-SMITH, and MINCHIN regarding the occurrence of similar forms in ticks obtained from animals infected with Piroplasmosis. Whereas some of these authors observed forms other than the club-shaped or cigar-shaped parasites similar to those referred to in this paper, the present author has been able to recognise these forms only.

Parasites of the same kind have been found to be scantily present in eggs from infected ticks, but none have been discovered in crushed seed ticks.

In addition to the gregarinoid parasite a spirochaete was also found. This parasite has not previously been reported in the United States, and it is suggested that it is identical with *S. theileri*.

No experimental evidence was forthcoming that the cigar-shaped parasite was actually a stage of *P. bigeminum*.

- (4) PORTER (Annie). **On Anaplasma-like Bodies in the Blood of Vertebrates.**—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 561-568. With 10 text-figs.

The summary of this short paper is as follows:—

“Anaplasmata may occur in healthy and in anaemic vertebrate blood. The structures, also called marginal points and peripheral coccus-like bodies, are probably of diverse origin. It is doubtful if they are organismal in nature.

“Anaplasmata have been found by me in warm and cold-blooded vertebrates, wherein conditions such as herpetomoniasis and anaemia occurred. Some of the bodies originate from the nucleus of the erythrocyte or erythroblast, under the influence of haemolysis.

“The Anaplasma-like bodies were basophilic, apparently composed of chromatin or of a substance giving a similar staining reaction, and were homogeneous in structure. They varied from  $0.3\mu$  to  $2.0\mu$  in diameter, often being about  $0.5\mu$ . Binary and multiple forms, which might be interpreted as phases of division, were seen.”

- (5) WILLIAMS (A. J.). **Report of the Treatment of Nuttalliosis or Biliary Fever in Army Horses at Secunderabad, Deccan, India.**—Army Headquarters, India. Quartermaster General's Branch, Simla, 1914. Calcutta: Superintendent Government Printing. pp. 1-6. With 1 fig. & 8 charts.

The characteristic symptoms of the disease are: Sudden onset, dullness, loss of appetite, yellow to orange discolouration of the mucous membranes, the presence of petechiae which are red at first and subsequently become purple, and often increasing in size and coalescing to form large blotches on the mucous membranes. The initial temperature may be as high as  $108^{\circ}$  F., and in severe cases there is marked prostration. Remissions occur about every third day, though the temperature never rises so high as at the onset of the disease.

There is rarely observed any haemoglobinuria during the course of an attack, but in a few cases it has been noticed after the lapse of some months.

If the cases are recognised and put under treatment promptly, complications such as acute congestions of the lungs, enteritis, etc., do not occur. Where the disease is known to exist, it is of the utmost importance that any horse showing signs of dullness and loss of appetite should be placed under careful observation and its temperature taken. The rapidity with which an affected horse is placed under treatment is of the greatest importance.

As the evidence in India points to the disease being spread by flies and mosquitoes, isolation must be promptly effected.

When ticks are found in stables they must be traced to their source and their further introduction prevented. They should be eradicated from the stables by the constant use of the blow lamp, as they penetrate into cracks in the walls and ordinary disinfectants, do not reach them.

Treatment:—Quinine sulphate given in two dram doses twice or three times a day together with 4 to 8 ounce doses of magnesium sulphate to regulate the bowels has not been found to be successful. In some cases the disease was controlled for a few days, but remissions generally occurred with considerable loss of condition. Good results were obtained with half-dram quinine acid hydrobromide; remissions generally occurred, but the animals were fit for duty in about a fortnight after the administration of a second dose.

The same drug in one dram doses yielded even better results.

Trypanblue has given excellent results, the temperature falling to normal within three days.

In some cases the action of trypanblue is more marked than that of quinine; this has been noticed in cases where examination of the blood showed no parasites but the presence of marginal dots suggesting anaplasmosis, and in these cases the disease is usually a severe form of biliary fever.

In some cases in which the quinine acid hydrobromide failed to arrest the remissions it was followed by trypanblue with good results.

In two cases which did not improve under treatment with trypanblue this drug was followed by the quinine salt and good results were obtained.

In all these cases magnesium sulphate was given as necessary.

Large doses of arsenic appeared to be entirely without effect upon the parasite.

In cases complicated by congestion of the lungs great relief was afforded by the intravenous injection of one or two pints of normal saline solution after venesection.

During convalescence the animals were given five grains of arsenic and one dram of sulphate of iron in bolus twice daily.

The after-effects of quinine injections.—When quinine acid hydrobromide, or quinine bi-hydrobromate (Howard's), in half to one dram doses in an ounce of water is used, staggering usually occurs immediately after the injection. These symptoms of syncope are most marked in animals with a very high temperature, in cases showing pronounced prostration, and in animals in poor condition. As a rule these symptoms pass off in from 10 to 20 minutes and no further symptoms occur, but cases should be kept under observation as occasionally toxic symptoms

appear a few hours after injection, the respirations are very accelerated, and the pulse very weak. In such cases one grain of strychnine given hypodermically soon gives relief.

It would appear that in some cases the parasites are very small and difficult to stain. It has often been noticed that while the chromatin stains intensely the cytoplasm stains faintly. Some of the larger pear-shaped parasites are granular and show a distinct central vacuole.

It not infrequently happens that parasites cannot be found except with prolonged searching in the early stages, even when the temperature is as high as 105° to 107°. But at the second rise of temperature and in the later stages of the disease they are generally found with ease.

The parasite has been found in cases showing simple oedema with no rise of temperature, and no other symptom of the disease. One attack appears to confer immunity, and up to the time of writing no recurrence had been observed in any animal treated with quinine or trypanblue. The cases were to remain under observation to see whether they would contract the disease again the following year.

No cases have been seen in mules or in country-bred horses, and very few Arabs contract the infection.

In view of the fact that the disease can be transmitted by blood inoculation, it appears to be probable that it may be spread mechanically by biting flies, and the observations made appear to indicate that this is in reality the case.

Although ticks are capable of spreading the disease, in outbreaks at Deesa, Neemuch, Nasirabad, and Ambala no ticks could be found on the horses nor in the stables. The disease appears to be more prevalent during and after the rains.

The following flies and ticks have been found :—

Haematopota have been found in cantonments and near tanks in the vicinity. They attack horses vigorously.

*Tabanus rusticus* has been seen but not caught. This fly has been observed to bite infected horses.

Hippoboscidae have also been seen.

*Hyalomma aegyptium* has been found on horses and cattle. Its presence on horses and in stables is accounted for by the proximity of bullock sheds and the storing of bedding in the sheds.

Rhipicephalus has been found on dogs.

The only satisfactory method of eradicating ticks from a stable is the constant and thorough use of the blow lamp.

In his conclusions the author emphasises the necessity of an early diagnosis and prompt treatment. The intravenous injection of quinine acid hydrobromide gives excellent results. The appearance of pronounced symptoms of depression may be cut short by the injection of strychnine. As a rule quinine only produces toxic symptoms in animals with a very high temperature; if there is a slight rise of temperature only, no such symptoms are produced.

For large horses a single dose of one dram is as a rule sufficient. For small horses and ponies half that dose should be given. The dose need not be repeated unless there are persistent remissions of temperature, and the membranes remain icteric.

At the commencement of an outbreak quinine should be tried on some cases and trypanblue on others as the one appears to be more efficient in some cases than the other, possibly owing to some difference in the strain.

In a letter dated January 7th, 1916, accompanying the report, the author states that the yellow quinine acid hydrobromide, which can conveniently be put up in tablet form, is preferable as it is easily soluble.

Since the report was written 300 cases of the disease have been treated in this way with only 11 deaths.

(6) MACFIE (J. W. Scott). *Babesiosis and Trypanosomiasis at Accra, Gold Coast, West Africa.*—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 457-494. With 2 plates & 6 charts.

In a tabular statement the author shows the results of the examination of a single film of blood taken from 100 of each of the following animals at the Accra slaughter-houses:—

TABLE I.—The results of the examination of 500 domestic animals for babesiosis.

[Host.	Number examined.	Number infected with piroplasms.	<i>B. bigemina.</i>	<i>T. mutans.</i>
Cattle, humped ..	100	53	7	49
Cattle, straight-backed ..	100	40	3	38
Sheep ..	100	21	—	21
Pigs ..	100	—	—	—
Goats ..	100	—	—	—
Totals ..	500	114	10	108

The humped cattle are for the most part bred in the north and driven down to the markets. The straight-backed cattle are bred in the south. Some of the sheep come from a distance to Accra, but the goats and pigs are probably all bred locally.

The infections appeared to be benign, but as many of the animals were also infected with other parasites, and especially with trypanosomes, no definite conclusion could be arrived at with regard to this point. The blood of the animals showed a variety of abnormalities indicative of anaemia. No experimental investigations could be made as no certainly uninfected animals were available for the purpose.

The following species of ticks were collected from the cattle and sheep:—*Boophilus*, *Amblyomma variegatum*, and *Hyalomma aegyptium*.

The parasite which the author considered to be *B. bigemina* in the humped cattle appeared to be rather smaller than that found in the straight-backed animals, and its chromatin was rather less distinct.

The smaller parasite was generally present in small numbers only, but in a few cases the infection was a heavy one. Examination of preparations from the spleens of a number of infected animals failed to reveal any "blue bodies."

The author quotes MINCHIN with regard to the nomenclature of the genera *Theileria* and *Babesia* and concludes that, to avoid confusion, it is advisable to identify the small pleomorphic parasite as *Theileria* (*Babesia*) *mutans*.

Only a single case of canine babesiosis came under the author's notice at Accra, and that was in a dog which had been imported six weeks previously. At the time when the examination of the blood was made parasites were numerous present.

A piroplasm, *Nuttallia decumani*, n. sp., of the brown rat (*Mus decumanus*).—

This parasite was discovered in the blood of four rats. From two of these only a single film was obtained, and in both parasites were rare. Of the other two one was under observation for just over a month, and the other had been under observation for two or three months at the time of writing.

In the first of these animals the piroplasms made their appearance a few days after capture and increased up to the 15th day, by which time a considerable number were present in the blood. They then diminished, and by the 26th day had become very scanty again. They were still present in very small numbers on the 37th day when the rat was accidentally killed.

Parasites were detected in the blood of the other rat on the day of capture and they persisted for ten days.

Both of these rats showed Grahamella in their blood when captured, but these subsequently disappeared.

The majority of the piroplasms were amoeboid or ring-shaped, with an irregular mass of chromatin. In some of them there were two distinct masses of chromatin, and these in some of the ring-forms were placed opposite each other.

In addition to these forms there were found a few which appeared to have undergone division, as there were four lanceolate parasites arranged in the form of a cross. In each of these there were two dots of chromatin.

Subcutaneous inoculations of infected blood into white rats failed to transmit the infection, and a single attempt to infect a brown rat with ticks from an infected animal also failed.

*Trypanosomiasis*.—Three types of trypanosomes were found, and these the author identifies as *T. pecaui* (*T. brucei* of Uganda; *T. ugandae*), *T. vivax*, and *T. pecorum* (*T. congolense*). These were found as shown in the following table in the smears used in the examinations for *Babesia*.

TABLE II.—Trypanosome infections found in animals killed at Accra slaughter-house.

Host.	Number examined.	Number infected with trypanosomes.	Percentages infected with		
			<i>T. vivax.</i>	<i>T. congolense.</i>	<i>T. pecaudi.</i>
Cattle, humped..	100	92	76	28	12
Cattle, straight-backed...	100	18	14	6	1
Sheep ..	100	4	3	2	—
Pigs ..	100	5	—	5	—
Goats ..	100	1	1	1	—
Totals ..	500	120	18.8	8.4	2.6

As tsetse flies are only found very occasionally in Accra it is probable that the animals are infected before they reach the town. Tsetse flies are quite numerous within a few miles of Accra. The identification of the trypanosomes found was based almost exclusively upon the appearances presented by the parasites in a single preparation from each animal. A few experimental inoculations were made and these are said to have confirmed the diagnoses.

The author gives a number of charts showing the measurements of the parasites found and their percentage distribution.

A single case of trypanosomiasis was found in a dog. In the blood of this animal there were parasites of the *congolense* type, but they were too scanty to permit of any measurements being made. The animal was in an emaciated condition, was covered with sores and had a profuse watery discharge from the eyes. The infection terminated fatally.

The number of cases of equine trypanosomiasis encountered by the author and the types of trypanosomes found are shown in the following table.

TABLE VI.—Equine trypanosomiasis at Accra.

Host.	Cases of trypanosomiasis.	Number infected with		
		<i>T. vivax.</i>	<i>T. congolense.</i>	<i>T. pecaudi.</i>
Horses ..	13	2	4	7
Mules ..	5	—	—	5
Donkeys ..	1	—	1	—
Totals ..	19	2	5	12

In one case in a mare the trypanosome found was of the *congolense* type, but differed from that organism in certain respects.

The disease in this case lasted for two months, and during that time distinct plaques were seen on at least two occasions.

The trypanosome was a rather short stumpy one without free flagellum. The centrosome was generally placed at a little distance from the posterior extremity, while the nucleus was frequently placed quite close to the anterior end. On some days 50 per cent. of the trypanosomes showed this disposition of the nucleus. The body was homogeneous or finely reticulated, and the undulating membrane was very poorly developed. In the final stages of the disease many of the trypanosomes showed a deeply staining chromatin dot posterior to the nucleus.

From a table of the measurements of 300 trypanosomes it may be gathered that the maximum length was 17 microns, and the minimum 8, and that the peak of the curve of distribution occurred at 12. Three white rats, two guinea-pigs, and a rabbit were inoculated, but none of them became infected.

On account of the clinical aspect of the disease the author suggests that the trypanosome should be called *T. congolense* var. *equinum*.

Two cases of trypanosomiasis resembling acute dourine are described at some length. Both animals were mule mares and in both cases a polymorphic trypanosome of the *pecaudi* type was found.

In both cases the onset of the disease was extremely sudden—the animals had been at work in the morning—and in both cases there was depression, slight subcutaneous oedema, commencing paralysis of the hind quarters, and a watery discharge from the eyes and nose on the afternoon. In both cases also plaques about the size of a shilling appeared on the skin on the day following the onset of symptoms. The animals had to be destroyed on the third day of the disease as they were in a hopeless condition.

A single guinea-pig was inoculated from each, but only one became infected. Trypanosomes appeared in the blood on the seventh day and the guinea-pig died on the ninth. The strain was unfortunately lost through the death of the guinea-pig inoculated from the first one after an interval of two days only. The maximum and minimum lengths of the trypanosomes as shown by 25 parasites were 33 and 13 microns.

The author thinks that, though these animals could not have been infected during copulation, it is not impossible that the trypanosome was the same as the polymorphic strain of the dourine parasite which YORKE and BLACKLOCK described as being indistinguishable from *T. rhodesiense* in 1913.

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#### TRYPANOSOMIASIS.

- (7) SERGENT (Ed.), SERGENT (Et.), LHÉRITIER (A.) & BÉGUET (M.).  
*Comparaison entre le Trypanosoma soudanense et le Trypanosoma berberum*. [Comparison between *T. soudanense* and *T. berberum*.]  
—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 650–653.  
With 1 chart.

In this paper the authors give the details of some experiments designed to test the correctness of the view that they had previously expressed regarding the non-identity of the two parasites.

In 1907 LAVERAN on the ground of cross immunity experiments expressed the view that the two trypanosomes were identical, but in 1912 the authors working with LAVERAN's strain of *T. soudanense* arrived at the opposite conclusion.

Subsequently LAVERAN again studied the question and reversed the cross-immunity experiments carried out in the first instance, but again came to the conclusion that the two trypanosomes are identical. Further cross immunity experiments by the present authors confirm their previous opinion that the two are distinct.

They therefore hold that the name *T. berberum* for the causal agent of debab should stand.

- (8) VELU (H.). *La Trypanosomiase des chevaux du Maroc. (Étude clinique).* [Equine Trypanosomiasis in Morocco. (Clinical study.)] — *Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 646-650. With 1 chart.

The symptoms presented by horses affected with trypanosomiasis in Morocco are in general those observed in other forms of chronic trypanosomiasis, with the notable exception that oedema is almost invariably absent. The onset of the disease is often unnoticed, but its course is marked by a progressive anaemia which shows at intervals acute phases.

The first symptom usually observed is the rapidity with which an animal becomes fatigued at work. While in the stable the animal is dull, and though the appetite is maintained it is capricious.

As the disease progresses the anaemia becomes more marked and there is increasing wasting and loss of condition. Together with this there is observed an uncertainty of gait, especially involving the hind legs. At this stage attacks of high fever occur. These are generally of short duration and more than two in a month are seldom observed. The temperature will run up three or even four degrees in a few hours. This elevation of temperature is accompanied by acute depression, difficulty of respiration, and acceleration of the pulse. These attacks may last from 12 hours to four or five days. After such an attack the animal returns to its former condition save that the anaemia and general cachexia are more pronounced. These attacks coincide with increases in the number of parasites present in the blood. It is also observed that while during the general course of the disease the visible mucous membranes are white or bluish, during the acute phases they become yellowish.

The disease is not invariably fatal, but when recovery takes place the period of convalescence is very protracted.

It is stated that in some cases there are pronounced symptoms of enteritis and jaundice. Only a relative value attaches to the presence of petechiae on the mucous membranes, as these are not infrequently seen in healthy horses in Morocco. In a few cases slight transient oedema has been observed, together with enlargement of the glands and lesions of an eczematous nature.

The blood is always pale and watery. The muscles are pale and infiltrated with serous liquid. The lymphatic glands are generally



enlarged and reddish in colour, and when an animal dies during an acute febrile attack there is marked enlargement of the spleen. The liver is frequently brownish in colour, and the intestine shows slight congestion.

Purely clinical diagnosis is a matter of some difficulty, but daily examination of the blood, especially when the temperature is elevated, enables one to establish a diagnosis with certainty.

- (9) LAVERAN (A.). *L'infection par Trypanosoma gambiense chez un maki, un renard, un raton, deux loirs, un meriones et deux gerbilles.* [A Lemur, Fox, a Raccoon, Two Dormice, a Merione,\* and Two Gerbils infected with *T. gambiense*.]—*Bull. Soc. Path. Exot.* 1915. Dec. Vol. 8. No. 10. pp. 745-751.

In this paper the author gives details of inoculations with *T. gambiense* of animals that are not generally used in laboratories.

Of two lemurs one was inoculated subcutaneously with blood from a guinea-pig infected with *T. gambiense*, and the other with blood of a guinea-pig inoculated with *T. rhodesiense*. The former survived for 26 days, after having passed through a slight crisis about ten days after inoculation. The latter died on the sixteenth day, trypanosomes having been present in the blood in increasing numbers from the fifth day up to the day of death.

The fox survived until the 56th day. During the course of the infection there were several crises, and at the time of death trypanosomes were scantily present in the blood. Opacity of the cornea was first observed on the 32nd day. This however disappeared, again to become visible after an interval of a few days. At the time of death there was complete opacity of the cornea of both eyes, and trypanosomes were present in large numbers in the aqueous humour. Apart from this the only lesion found at the post-mortem was enlargement of the spleen.

In the raccoon the period of incubation was twelve days, and the duration of life 31 days. Prior to the appearance of the trypanosomes in the blood there was marked agglutination of the red corpuscles. There was one crisis during the course of the infection, and at the time of death parasites were scantily present in the blood.

In a dormouse that was inoculated intraperitoneally the period of incubation was three days, and death took place on the seventh day. Another dormouse which was inoculated subcutaneously lived until the 22nd day, the period of incubation having been seven days. In both cases the trypanosomes steadily increased in numbers in the blood up to the time of death.

The merione which was inoculated subcutaneously showed trypanosomes in its blood on the eighth day, and died on the 31st day. The course of the infection was marked by three crises, and at the time of death parasites were very scantily present in the blood.

In the gerbils inoculated subcutaneously and intraperitoneally the periods of incubation were nine and two days respectively, but death took place on the 19th day in both cases.

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\* Meriones: a genus of Muridae.

- (10) LAVERAN (A.). **Diminution de virulence chez des trypanosomes ayant subi un grand nombre de passages par animaux de même espèce.** [The Diminution in Virulence of Trypanosomes that have been passed through a Long Series of Animals of the Same Species.]—*Bull. Soc. Path. Exot.* 1916. Feb. Vol. 9. No. 2. pp. 109–117.

The author has frequently found that, when strains of trypanosomes are maintained by passing them from animal to animal of the same species for long periods, there is a tendency for them to lose virulence for that species to such an extent that not only is the period of incubation prolonged and the course of the disease lengthened but actual recovery may take place. In such cases there is a risk of losing the strain, and the best way of reviving the virulence is to transfer it to an animal of another species and maintain it in that species for a time before using it again for the inoculation of animals of the species originally employed.

In this paper details are given of a number of experiments with a strain of *T. congolense* and a strain of *T. gambiense* illustrating these points.

- (11) RODHAIN (J.). **Note sur les Trypanoses et les Piroplasmoses des grands animaux de l'Ouellé.** [Note on the Trypanosomiasis and Piroplasmoses of Large Animals of the Ouellé District.]—*Bull. Soc. Path. Exot.* 1916. Feb. Vol. 9. No. 2. pp. 95–109. With 1 text-fig.

In this paper the author describes parasites encountered in the north-eastern portion of the basin of the Congo.

Among 89 domestic cattle examined 13 were found to be infected with *T. congolense* and *T. cazalbovi*. Of nine sheep one was found to be infected with *T. congolense*. The examination of the blood of nine Equidae and 21 kids was negative in every case.

These figures must not be taken as indicating the percentage of animals infected, as circumstances prevented the author from carrying out full investigations. It was practically only those animals which showed clinical evidence of infection that were examined.

It is remarkable that no dimorphic trypanosomes were found.

As wild animals form the reservoir from which the domesticated animals derive their infection, a certain number of these were also examined. Although blood from 50 animals belonging to twelve species was examined either between a slide and coverglass or in stained preparations, not a single one was found to harbour pathogenic trypanosomes. There is no doubt, however, that if it had been practicable to carry out systematic inoculations infected animals would have been detected.

The author draws special attention to the fact that in none of the districts where the game were examined was *Glossina* present in large numbers.

A trypanosome of the *ingens* type was found in the blood of one *Cephalophus dorsalis*.

Three species of Glossina, *G. palpalis*, *G. morsitans*, and *G. fusca*, are found in the Ouellé territory. The development of trypanosomes in the first two species is fairly well known, but little is known regarding their development in *G. fusca*. Six infected individuals of this species were found among 26 dissected. In four instances the multiplication of the parasites was limited to the proboscis. In two the multiplication was taking place in the intestine and the proboscis. In no case was there any invasion of the salivary glands.

In one case in which multiplication was going on in the proboscis only the process was complete, as metacyclical or salivary forms were found in the lumen of the tube.

In view of what is known regarding the development of trypanosomes of the *cazalboui* and of the *congolense* types in the other species of Glossina it would appear to be probable that *G. fusca* is capable of transmitting these species.

Bovine piroplasmoses.—

*Piroplasma bigeminum* has been found once only.

A parasite referred to as *Theileria mutans* appears to have a wide distribution in the Ouellé region. In order to exclude the possibility of this parasite being in reality *T. parva*, the author carried out a number of gland punctures, but failed to find any developmental forms of the parasite.

The author refers to the parasite under the name mentioned because of the morphological resemblance to *T. parva*. He has not been able to carry out any experimental inoculations with blood.

At DOUNGOU, RENZI, and AMADIS the author was struck by the poor development of many of the calves, and is inclined to attribute it to infection with piroplasms during very early life.

*Ovine piroplasmosis*.—The author confirms the occurrence of piroplasmosis in sheep and states that the disease appears to have a wide distribution.

Morphologically the parasite resembles *T. mutans* but differs from it in the almost complete absence of bacillary forms. In Romanowsky preparations the majority of the parasites appear rounded or oval, with a few comma-shaped forms. The chromatin is always marginal and solid-looking. In the young parasites it is in the form of a rounded mass, but in the ring-shaped parasites it is elongated and lies along the periphery of the ring.

Multiplication is generally by binary fission. In blood that is heavily invaded and in which multiplication is progressing rapidly cross-forms which have been described as typical of the genus *Theileria* may occur.

The author suggests the name *Theileria ovis* for this parasite. He has also constantly found in the red corpuscles of the infected sheep bodies resembling anaplasmata. He is not convinced as to their parasitic nature.

In transmission experiments from sheep to sheep these bodies have made their appearance in a rather irregular manner, before, simultaneously with, or after the appearance of the piroplasms. They are not constant in size, some measuring less than one micron in diameter and others being nearly twice this size. It is possible that these are two distinct structures. The larger ones are said to resemble nuclear remains.

Attempts to differentiate between *T. ovis* and the anaplasma (?) by means of trypanblue failed because the drug did not cause the complete disappearance of the piroplasm.

The lesions found in an animal killed for the purpose of post-mortem examination were as follows: There was marked emaciation, no bile staining of the tissues, petechiae in the subcutaneous connective tissue and at the apex of the heart, in the right ventricle and on the abdominal surface of the diaphragm. Slight oedema at the base of the lungs, spleen normal, liver enlarged and congested. Kidneys enlarged, capsule easily stripped. Traces of albumen in the urine. Cervical glands slightly engorged.

A few inoculation experiments were carried out, but no definite conclusions can be based on the results. They appear to indicate however, that young kids are susceptible to a slight extent, and that the inoculation of young lambs gives rise to a slight but chronic infection. Some of the negative results obtained with adult animals may possibly be explained on the hypothesis that immunity is acquired early in life.

The parasites persist in the blood for long periods, and any depression of the vitality of the animal is followed by an increase in their number.

In the course of his investigations the author has found two specimens of *Cobus defassa* infected with a piroplasm morphologically resembling the larger forms of *T. mutans*.

A single cross-bred dog of European origin was found to be infected with piroplasmosis. Examination of a number of native dogs failed to reveal a single case of infection.

The author gives the following list of flies which he captured and identified:—*Stomoxys calcitrans*, *Lyperosia minuta*, *Lyperosia punctigera*, *Glossina palpalis*, *G. morsitans*, *G. fusca*, *Chrysops silicea*, *C. distinctipennis*, *C. funebris*, and another species as yet unidentified, *Tabanus socius*, *T. secedens*, *T. ruficrus*, and *T. biguttatus*, and a series of other species not yet identified, including a large group of *Chrysozona* [*Haematopota*].

- (12) SERGENT (Ed.) & LHÉRITIER (A.). **Longue incubation ou latence d'infections à trypanosomes chez des chiens inoculés avec des virus provenant de chèvres.** [Long periods of Incubation or Latent Infection in Dogs inoculated with Virus derived from Goats.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 653-655.

The authors record the occurrence of a period of incubation of 2 months and 24 days in a dog inoculated with 100 cc. of blood from a goat infected with *T. maroccanum*, while another inoculated with 110 cc. of blood from a similar source showed a period of incubation of 7 months and 11 days.

In a dog inoculated with 110 cc. of blood from a goat infected with *T. berberum* the period of incubation was exactly 8 months, while in another case it was 5 months and 13 days.

In these cases the course of the disease was exactly the same as in cases in which the period of incubation is of the ordinary length.

The blood of the dogs was examined thrice weekly.

- (13) MACFIE (J. W. Scott). **A Note on a Trypanosome of the Black Rat (*Epimys rattus*).**—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 527–534. With 1 plate comprising 18 figs.

The trypanosome described in this paper was found in a black rat at Accra. The parasites were present in the blood in enormous numbers and, though of the *lewisi* type, they were found to be remarkably polymorphic. Two types of motility were observed, one when the parasites were progressing rapidly, which involved the whole of the body, and the other when the parasites were stationary, in which there was a rapid vibration of the anterior extremity of the body.

In a stained preparation measurements were made of a hundred consecutive individuals, and it was found that the length ranged from 15 to 48 microns, about half of them being upwards of 30 microns in length. The breadth varied from 2 to 6 microns, but the majority approximated to the smaller measurement. These measurements do not represent the maximum and minimum, as an individual measuring 52 microns, and one measuring 12 were found. Aggregations of dividing forms were also observed.

In all forms the posterior end of the body was long and tapering. The micronucleus was often oval or rod-shaped. The nucleus was placed well forward in the body. The undulating membrane was poorly developed, and there was a free portion to the flagellum. The body was generally quite free from granules. In some of the small forms the micronucleus was close to or even in front of the nucleus. In some of the largest specimens the posterior extremity of the body was prolonged into a whip-like lash and there were forms connecting these with the smaller types. In some of these large forms the length from the micronucleus to the posterior end of the body was as much as 24 microns.

The types of trypanosomes in the blood differed from day to day, and the author thinks that the parasite may be identical with *T. eburneense* described by DELANOË, although that author made no mention of the forms with the posterior prolongations.

Inoculation of a white rat and a guinea-pig failed to set up infection.

The author notes that BROWN'S\* observations regarding a pathogenic strain of *T. lewisi* may possibly indicate that *T. eburneense* is a variety of *T. lewisi*.

- (14) MESNIL (F.) & BLANCHARD (M.). **Sensibilité au sérum humain normal de Trypanosomes d'origine humaine.** [The Susceptibility of Trypanosomes of Human Origin to Normal Human Serum.]—*Bull. Soc. Path. Exot.* 1916. Feb. Vol. 9. No. 2. pp. 81–85.

The authors give details of three experiments with regard to the action of human serum upon a strain of *T. gambiense*.

The results may be summarised as follows:—

Up to the present five strains of human trypanosomes have been studied in connection with the effects produced by human serum upon them. Two strains of *T. rhodesiense* have shown themselves to be

\* See this *Bulletin* 1914, Sept. Vol. 2. No. 3. p. 130, & 1915, June. Vol. 3. No. 2. p. 48.

relatively susceptible to the action of human serum. A strain of *T. gambiense* studied by LAVERAN has proved itself to be resistant after having been maintained for 12 years in laboratory animals.

A strain of *T. gambiense* carried on by the authors when tested for the first time seven years after isolation from the human subject possessed a somewhat slight degree of susceptibility. During the last four years the degree of susceptibility has been slightly variable and at present it is about the same as that of *T. rhodesiense*.

The Lanfranchi strain about two years after its isolation possesses about the same degree of susceptibility as *T. rhodesiense* and the author's strain of *T. gambiense*.

- (15) VAN DEN BRANDEN (F.). *Valeur moyenne de la durée de stérilisation sanguine chez les trypanosés par une dose de salvarsan, néosalvarsan, salvarsan cuprique et sel sodique du salvarsan cuprique.* [The Average Duration of the Sterility of the Blood of Persons infected with Trypanosomiasis produced by Salvarsan, Neosalvarsan, Copper Salvarsan, and the Sodium Salt of Copper Salvarsan.]—*Bull. Soc. Path. Exot.* 1916. Jan. Vol. 9. No. 1. pp. 13-15.

In tabular statements the author gives details of cases of trypanosomiasis treated by the drugs mentioned in the title of his paper. The cases were selected, the patients being in good condition, and the cerebro-spinal liquid normal.

Salvarsan.—A single dose of 0.01 g. per kilog. produced sterilisation of the blood for periods ranging from two to eight months.

Neosalvarsan in a dose of 0.013 g. per kilog. appeared to be effective for periods ranging from 4 to 22 months.

Copper salvarsan in a dose of 0.004 g. per kilog. cleared the blood of trypanosomes for periods ranging from 19 to 24 months.

The sodium salt of the foregoing in a dose of 0.0053 g. per kilog. was effective for periods ranging up to 12 months.

Four cases were treated with each drug, and it is pointed out that the periods in some cases may in reality be longer than stated as the patients have to be examined again.

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#### LEISHMANIASIS.

- (16) LAVERAN (A.). *Nouvelle contribution à l'étude des infections expérimentales de la souris par *Leishmania tropica*; un cas d'infection de la gerbille.* [Experimental Infection of the Mouse with *Leishmania tropica*, and a Case of Infection in the Gerbil.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 680-686.

The author gives the details of two white mice and a gerbil inoculated with *L. tropica*, in each of which there were lesions about the tibio-tarsal articulations. The two mice were inoculated intraperitoneally from another mouse, and the gerbil was inoculated intraperitoneally on seven occasions with cultures of the same parasite. In one of the mice there was a general infection, but in the other two animals the

lesions were limited to the scrotum and the skin. The parasites were present in large numbers in the serous exudate around the affected joints. In the gerbil there was also ulceration of the nose.

The author draws attention to the fact that the gerbil is common in areas where oriental boil is endemic, and suggests that although natural infection in this animal has never yet been recorded it may nevertheless prove to be the reservoir of the virus.

The infection is not invariably fatal in the mouse, as in one instance a mouse which had been inoculated 11 months previously and developed typical lesions in which the parasite was found, had apparently made a complete recovery four months before it was killed. At the post-mortem no trace of infection could be found.

Attempts to infect mice by ingestion and through the medium of fleas have constantly given negative results.

The author states that he has inoculated at different times 47 mice with *L. infantum* and *L. donovani*, but in no case have any lesions of the skin been observed.

- (17) TOWNSEND (C. H. T.). **The Insect Vector of Uta, a Peruvian Disease.**—*Jl. of Parasitol.* 1915. Dec. Vol. 2. No. 2. pp. 67-73. With 4 text-figs.

The author's summary is as follows:—

"1. The disease known as *uta* occurring on the west face of the Andes in Peru, has been proved to be due to *Leishmania*.

"2. Two species of *Forcipomyia*, native to the western Andean region, appear to be proved to be capable of transmitting the *Leishmania* of Uta.

"3. It is highly probable that the various forms of *Leishmaniasis* thus far known are due to as many species of herpetomonads originally parasitic in the gut of the insect-carriers concerned, and that, with regard to the occurrence in man, these herpetomonads are as yet in the stages of parasitism ranging from habitually abnormal or frequent to mere accidental or infrequent."

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#### UNDULANT FEVER.

- (18) NICOLLE (Ch.) & GOBERT (E.). **Seconde enquête sur les chèvres laitières de Tunis au sujet de la fièvre méditerranéenne.** [Second Inquiry into the Distribution of Mediterranean Fever among Milch Goats in Tunis.]—*Bull. Soc. Path. Exot.* 1916. Feb. Vol. 9. No. 2. pp. 86-95.

The prohibition of the importation of goats from Malta into Tunis was followed by a marked diminution in the number of cases of Mediterranean fever in the human subject. In 1909, when the importation was stopped, 40 positive results were obtained in agglutination tests carried out with human serum at the Pasteur Institute at Tunis. This figure rose to 63 in 1911 and then rapidly fell, so that in 1914 only 7 positive results were obtained. In this connection it may be noted that only those cases were considered positive in which the agglutination titre was higher than 50.

The second enquiry into the disease was instituted because during 1915 the number of cases rose again to 40.

The investigations were carried out during the last six months of the year, and the following animals were examined: 2,354 goats, 14 donkeys, 9 cows, 7 dogs, 4 horses, and 2 cats.

Of the goats 1,277 were Maltese, and 1,044 Arab, the remainder being crosses.

The emulsion used in the agglutination tests was prepared from a strain of the organism isolated in 1909 from a Tunisian goat, and was the one used in the tests of human patients. The liquid used in the preparation of the emulsion was 7 per mille sodium fluoride. The emulsion contained 800 million bacteria per cc. Sodium fluoride is said to be valuable for the preparation of the emulsion as it preserves the chief reactions of the bacteria for long periods without sensible loss. The authors consider that emulsions prepared in this way are as sensitive as living cultures. Provided such an emulsion be kept at a low temperature, it may remain in a suitable condition for two years.

The experience gained by the authors in carrying out tests with human serum and the fluoride emulsion lead them to consider reactions below 1 in 20 as doubtful, reactions from 1 in 40 to 1 in 60 very suspicious, and those in higher dilutions as definitely positive.

Judging on this standard, the results obtained with the sera of the goats tested showed that of the total number (in round figures) 97 per cent. gave negative or doubtful reactions and 3 per cent. gave suspicious or positive reactions.

The figures for the Maltese goats alone show that 95 per cent. gave negative results and 5 per cent. suspicious or positive reactions.

The Arab and cross-bred goats yielded 99·3 per cent. negative results and 0·7 per cent. indicating probable infection.

The herds examined could be divided into four groups according to the locality in which they were placed, and on examining the figures given by the different groups it was found that the percentage of affected animals was markedly different in the various groups, those herds giving the higher percentages in which the larger number of Maltese goats was included. It was further found that the distribution of the infection was not even in any one group.

On comparing the distribution of the cases of the disease in the human subject with that of the cases in the goats it was found that the areas giving the greater numbers of cases coincided.

It is suggested that, although up to the present the disease has been found to be far more frequent in the Maltese than in native goats, the organism may in time acquire an exalted degree of virulence for the native animals or the cross-breds than for the Maltese animals.

The authors lay down regulations based upon those in operation in Malta for the control of the disease.

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## RABIES.

- (19) PHISALIX (Marie). **Les propriétés vaccinantes de la sécrétion cutanée muqueuse des Batraciens contre le virus rabique sont indépendantes de celles qu'elle possède contre sa propre action et contre celle du venin de Vipère aspic.** [The Vaccinating Properties of the Mucoid Cutaneous Secretion of Reptiles against the Virus of Rabies are Independent of those which it possesses against its own Virus and that of the Adder.]—*Bull. Soc. Path. Exot.* 1915. Dec. Vol. 8. No. 10. pp. 730-731.

In experiments carried out by the author two axolotls or three brown frogs were placed in a vapour of ether and then washed with 15 cc. of distilled water. To the solution of the mucoid secretion thus obtained was added a little ether, and the mixture was placed in an ice chest for 48 hours. The liquid then had dissolved in it 10 mg. of dried adder venom. In sealed pipettes the liquid was heated in a water bath for 15 minutes at 75° C. The effect of this was to destroy the toxicity of the venom without altering its protective properties, nor those of the mucoid secretion.

The mixture was injected every second day in doses increasing from 1 to 5 cc. into the aural vein of rabbits. On the third day after the final injection the rabbits were inoculated intracranially with fixed virus. None of the animals developed rabies.

Subsequent inoculations with fixed virus at intervals of two, three, and four months showed that the immunity that had been acquired lasted for about two months.

It is pointed out that the immunising substance or substances do not result from a chemical reaction between the components of the mixture, nor from the heating, as the same results can be obtained if the secretion and the venom are injected in succession whether heated or unheated.

Whereas the mucus from the skin of the adder is both toxic and protective against its own action and protective against that of the salamander, that of the frog possesses neither of these properties, but is nevertheless protective against the virus of rabies. The conclusion must therefore be drawn that the substance present in the mucoid secretions of reptiles which immunises against the venoms is not the substance which immunises against rabies.

This secretion is also interesting from the fact that it is capable of developing physiological properties without undergoing any physical change. In *Proteus anguinus* and *Dactylethra laevis* it is innocuous, and justifies the comparison that has been made between it and the sweat of mammals. In *Rana temporaria* it exhibits powers of producing inflammatory conditions. In *Rana esculenta*, *Alytes obstetricans*, *Salamandra maculosa*, and *Siredon mexicanus* it is clearly toxic. It is only protective in its action against the toxic mucus and venom of *Vipera aspis* in *Siren lacertina*. In *Rana temporaria*, where it is neither toxic nor protective, it possesses the power of protecting against rabies.

- (20) ZELL (C. A.). **Rabies, Diagnosis and Treatment.**—*Amer. Jl. Vet. Med.* 1915. Nov. Vol. 10. No. 11. pp. 835-836 and 887-890.

The author has found that the complement fixation test can be used for the diagnosis of rabies if the antigen be prepared from the submaxillary glands of rabid dogs. The antigen is prepared by excising the glands, mincing them, and placing them in distilled water under a vacuum of 28 inches for at least an hour. The turbid liquid which is obtained is filtered through a Berkefeld filter. This antigen deteriorates rapidly, and it was found that an alcoholic extract made according to the Wassermann technique could be used equally well. In experimentally infected animals positive results were obtained several days before any symptoms were shown, the diagnosis being confirmed by the discovery of Negri bodies.

On one occasion the author's attention was drawn to a case of rabies in a horse in a barn where fifty other horses were stalled. The animal was too violent to permit any blood being taken, but blood was obtained from all the other horses and five gave positive reactions. The team-mate of the horse killed, the team stalled next to it, and two other horses known to have been bitten by the rabid horse gave positive results. These animals were treated and remained healthy.

With regard to the Pasteur treatment, the author's observations lead him to the conclusion that no antibodies can be demonstrated in the blood until three weeks after the completion of the treatment. This explains the occasional deaths occurring in people bitten about the face and neck.

The author has produced an immune serum by hyperimmunisation against street virus. A number of guinea-pigs were treated with immune serum on three occasions. They were then inoculated after an interval of a week with virus, some being done subdurally, some intramuscularly, and some into the anterior chamber of the eye. The first group nearly all died of rabies, while the majority of the remainder proved to be immune.

Guinea-pigs inoculated with rabies and then given injections of serum died if the interval elapsing between the inoculation with virus and the administration of serum was more than two days. The results obtained when the virus and serum were mixed were very similar to those obtained when the virus was given after the serum.

The five horses referred to above which yielded positive results to the complement fixation test were treated with the author's protective serum.

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#### PROTOZOA.

- (21) MACFIE (J. W. Scott). **A Case of Dysentery in a Monkey, in which Amoebae and Spirochaetes were found.**—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 507-512. With 1 plate comprising 12 figs.

The monkey referred to in this paper was one infected with a strain of human trypanosome which was sent to the author at Accra. The animal died on the 65th day after inoculation and at the post-mortem

examination, apart from general emaciation and anaemia, the most marked lesions were severe ulceration of the large intestine and enlargement of the spleen. The lymphatic glands were not enlarged, and the monkey had shown no symptoms of trypanosomiasis during life.

In preparations from the contents of the large intestine numerous amoebae were found. The organisms in stained preparations measured from 12 to 30 microns in diameter, but the great majority approximated to the smaller measurement. Some of the larger ones contained a number of red blood corpuscles. Numerous cysts were seen which possessed a thick wall and contained a single large vacuole. In the narrow band of cytoplasm a number of faintly stained nuclei could be detected.

In addition to these amoebae immense numbers of spirochaetes were present in the contents of the large intestine. They ranged from 4 to 7 microns in length, were very slender, and had pointed extremities. Few of the parasites showed more than two coils. The author does not think that the spirochaete was pathogenic and draws attention to the fact that it very closely resembled *S. eurygyrata*, which has been found in the faeces of apparently healthy people.

(22) SCOTT (J. W.). **Some Notes and Experiments on *Sarcocystis tenella*, Ralllet.**—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1. pp. 20–24.

It has been suggested by DARLING that "the sarcosporidia may be varieties of Neosporidia of invertebrates which have invaded the muscular tissue of a host where they cannot complete their development and from which they cannot escape." The author of the present paper has made some observations which tend to favour a similar view, but of this he has not as yet obtained any experimental evidence.

It would appear that the range sheep of Wyoming are infected with the parasite to an extent ranging from about 70 to 100 per cent. No parasites in the Balbiana stage have been seen. An experiment in which five young lambs were fed with pieces of heart muscle containing the parasite yielded an entirely negative result, and control lambs kept under the same conditions were also found to be free from infection at the time of slaughter.

In view of the suggestions that have been put forward by various authors that the parasite must have an intermediate host, the author carried out an experiment to test whether the parasite might be liberated by digestion in a carnivorous animal and thus rendered capable of infecting fresh animals.

A dog was fed twice with heavily infected heart muscle from sheep, and after a few days when the grass upon which the cage stood was well covered with faeces two lambs were placed in the cage where they remained 33 hours. After an interval of about three weeks a further pair of lambs were placed in the cage and left for 24 hours. None of these became infected.

In another experiment two groups of animals were kept respectively upon a pasture that was partly swampy and partly dry and one that was very dry. Infected muscle was scattered over both. When the lambs were killed 55 per cent. of those on the swampy ground were found to be infected, and 21 per cent. of those on the dry pasture.

It is pointed out, however, that these infections were probably contracted naturally, as the feeding of infected muscle direct to animals failed to cause infection.

If the view be taken that the presence of sarcosporidia in sheep is more or less accidental, the difference in the percentage of animals infected upon the two pastures may be explained in another way. The conditions in the pasture that was partly swampy favoured the occurrence of various insects, and the possibility is suggested that the sheep might become infected in a more or less accidental manner by ingesting either the insects which are the hosts of the parasite or their droppings.

This explanation favours DARLING'S view that the sheep is not the definitive host of the parasite.

- (23) RODHAIN (J.). *Quelques hématozoaires de petits mammifères de l'Uele (Ouélé), Congo Belge.* [Some Haematozoa of Small Mammals at Uele, Belgian Congo.]—*Bull. Soc. Path. Exot.* 1915. Dec. Vol. 8. No. 10. pp. 726-729. With 3 text-figs.

*Trypanosoma dendromysi* n. sp.—This parasite was found in the blood of a climbing mouse (*souris grimpeuse*) which has not yet been identified, but is fairly common at Aba on the border of the Mongalla district. Five out of six mice examined were found to be infected.

In the fresh state the parasite, which is of moderate size, executes slow translatory movements which allow of a fairly close study of the changes of shape shown by it during the process.

The nucleus, which is oval or rounded, is situated in the anterior third of the body. The blepharoplast is very small and is marginally placed at a little distance from the posterior end. The undulating membrane is narrow and is bordered by a flagellum of which about one third is "free." The body contains no granules, but sometimes shows one or more vacuoles. The length of the parasite ranges from 30 to 33 microns and the width from 4 to 5. The free portion of the flagellum measures about 10 microns.

The parasites were always very scanty in the blood. Intraperitoneal inoculation of a guinea-pig and a young savannah mouse failed to cause infection in either.

Haemogregarine of *Cricetomys gambianus*.—The parasite found in the red corpuscles of this animal closely resembles *Haemogregarina balfouri*.

The invaded cells become elongated and pale in colour. In the cells the parasites appear as vermicules with rounded ends, and are sometimes slightly curved. They measure about 10 microns in length and rather less than 4 in width. The nucleus, which is generally placed towards one end, occupies about two-thirds of the body.

Grahamella was also present in the blood of the infected rats.

Plasmodium of *Epomophorus franqueti*.—The author has found male and female forms of a plasmodium in the blood of four flying foxes, and diagrams of these are given.

- (24) FANTHAM (H. B.) & PORTER (Annie). **Some Experimental Researches on Induced Herpetomoniasis in Birds.**—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 543–558. With 1 plate comprising 40 figs.

The authors record the successful infection of birds with *Herpetomonas jaculum* from the water scorpion, and *H. culicis* from *Culex pipiens*.

The birds used were canaries, sparrows, and martins. In the feeding experiments the birds were fed either with the entire insects or with their alimentary canals only. The insects used—*Nepa cinerea* and *Culex pipiens*—were obtained in the neighbourhood of Cambridge.

A canary fed with material containing *H. jaculum* died on the 51st day. A film of blood made on the 21st day showed elongating post-flagellate forms of the parasite. Parasites were found a fortnight later when the bird showed evidence of being ill. There were also symptoms of illness on the day of death. During the course of the experiment the bird's weight fell from 26 g. to 10·2 g.

Preparations made from the organs showed that the liver contained leishmaniform bodies, a few elongating forms and flagellate forms in very small numbers. Leishmaniform types and developing forms were found in spleen, heart, lungs, and kidneys. Although the suprarenal bodies were very firm they showed no parasites.

An experiment in which a sparrow was fed with *Culex pipiens* terminated with the death of the bird on the 9th day. In this case also there was a generalised infection with *H. culicis*, but no parasites were found in the blood or in the intestine. Examination of the blood 14 hours before death occurred revealed a single organism in the process of elongating.

A small number of other experiments are briefly recorded in which the results obtained were similar to those referred to.

In a single inoculation experiment the bird, an adult martin, died after two days. No evidence of infection could be detected.

It is noted that in the more chronic infections the leishmaniform parasites predominated, while in the acute cases the flagellate forms were more numerous present, but that the experiments are as yet too few in number to warrant any general conclusions being drawn with regard to this.

*H. jaculum* in the non-flagellate forms is oval, and shows a nucleus and a well marked blepharoplast. The flagellate form is produced by a process of elongation, which is often preceded by division of the nucleus and blepharoplast, and the development of the flagellum. When need arises for a new host the flagellum is absorbed, the body becomes concentrated, and a thin cyst wall is produced. This form of the parasite is adapted to existence outside the host. When ingested by a new host the leishmaniform parasite is again produced.

In the experimentally infected canary the non-flagellate forms were from 4 to 6·6 microns in length by 2 to 5 in breadth. They were generally found singly. Dividing forms of the parasite at this stage were not numerous. In the flagellate stage the parasites resembled those present in the insect, but they did not attain so great a length.

The life-cycle of *H. culicis* is similar to that of the foregoing parasite. In the non-flagellate stage the parasites are about the same size.

although a few larger forms were encountered in *H. culicis* than in *H. jaculum*, and various stages of division were also found. The body of the flagellate forms ranged from 11 to 16 microns in length, and the flagellum was often about the same length. The parasites varied in width from 8.5 to 3.6 microns.

In all cases the parasites were far more numerous in the internal organs than in the circulating blood.

Among the general conclusions drawn it is stated that the various species of *Leishmania* are probably insect herpetomonads usually perpetuating the non-flagellate stage which is the more resistant, and a summary of the evidence tending towards this conclusion is given.

- (25) WEIDMAN (F. D.). *Coccidium bigeminum* Stiles in Swift Foxes (Habitat Western U.S.)—*Jl. Comp. Path. & Therapeut.* 1915. Dec. Vol. 28. No. 4. pp. 320-323. With 3 text-figs.

This parasite was found in two swift foxes, both of which were suffering from diarrhoea. One of the animals was passing large numbers of oocysts and the infection terminated fatally. In the case of the other animal the parasites were present in the faeces in small numbers only, and spontaneous recovery took place.

In fresh faeces double-contoured cysts with one or two spores may be found. Some of them are nearly spherical, measuring about 30 microns in each diameter. Others may be as long as 40 microns.

In faeces diluted with tap water and kept under observation continuously it was found that the single-spore forms divide by a process of constriction in from four to six hours. Within 24 hours each spore acquired a double-contoured envelope and contained four banana-shaped sporozoites and a granular residual body. This subsequently became hyaline.

Post-mortem examination revealed extensive haemorrhagic ulceration of the small and large intestines. The ulcers extended down to the muscularis mucosae. No parasites were found in the epithelial cells, but two or three naked protozoa measuring from 15 to 21 microns in their long diameter were found on the margins of ulcers. Double-contoured forms were also found on the surface of the mucous membrane.

The parasites observed in these animals appear to be larger than those previously described as occurring in the dog and the cat, and the author therefore suggests the name *canivelocis* for this variety. Although parasites of this species are not generally credited with possessing pathogenic properties, it would appear that in one of these cases they were responsible for death.

- (26) MINCHIN (E. A.). Remarks on the Nature and Significance of the so-called "Infective Granules" of Protozoa.—*Ann. Inst. Past.* 1915. Nov. Vol. 29. No. 11. pp. 537-544. With 2 text-figs.

The author points out that the term "granule" used by FRY and RANKEN and other authors for small bodies extruded by protozoa is in reality a misnomer. The particles are not cell-granules, but endogenous buds which when complete have the morphological and

cytological value of true cells. To establish this interpretation the author points out that many examples of endogenous budding are known among the protozoa, and special reference is made to the process occurring in an amoeba described by LISTON and MARTIN. The processes observed in this organism are compared with those described by FRY and RANKEN as occurring in trypanosomes.

In LISTON and MARTIN'S observations the amoebae were seen to extrude tiny buds from their cytoplasm which moved away and subsequently grew to the size of the parent organism. In fixed preparations numerous chromidial grains could be seen in the cytoplasm, and in the process of bud-formation a quantity of cytoplasm became separated off round a group of these grains which became clumped in the centre, the whole structure being then extruded. The principal nucleus of the organism took no part in this process of reproduction. Several such buds could be seen in a single amoeba.

In the corresponding process in the trypanosomes a small group of chromatin grains are extruded by the trophonucleus. These pass to the surface and are cast out. As they increase in size the differentiation of the trophonucleus and the kinetonucleus becomes apparent. Later a flagellum grows out from the neighbourhood of the kinetonucleus, and the organism develops into a trypanosome. The apparent absence of any cytoplasm in the buds formed by trypanosomes is explained as being a defect of the Romanowsky method of staining.

The author concludes that "infective granule" is a misleading term and that it should be replaced by "endogenous bud-formation."

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#### HELMINTHS.

- (27) WEIDMAN (F. D.). *The Distribution of Uncinaria among the Lower Animals.*—*Jl. Comp. Path. & Therapeut.* 1915. Dec. Vol. 28. No. 4. pp. 323-326.

During the past thirteen years fourteen cases of uncinariasis have been found in animals autopsied at the Zoological Gardens, Philadelphia. The tabular statement on following page shows the distribution of these parasites.

It is seen that seven of the cats came from districts where hookworm disease occurs.

The paper contains a short summary of the previously recorded cases of uncinariasis in animals.

- (28) LINTON (E.). *Cestode Cysts from Muskrat.*—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1. pp. 46-47. With 1 text-fig.

In this short paper the author describes the occurrence of four cysts in a muskrat—three in the liver and one in the peritoneum—which proved on examination to be *Cysticercus fasciolaris*.

TABLE SHOWING INCIDENCE OF UNCINARIA. [WEIDMAN (F. D.).]

Autopsy Number.	Year.	Name of Animal.	Habitat.	Number of Males.	Number of Females.
919	1906	Grey wolf	Western United States	8	2
1001	1907	Grey fox	Western United States	34	33
1157	1907	Jaguarundi	South America	3	4
1715	1909	Wild cat ( <i>Felis ruffus</i> )	South Carolina	1	1
2241	1911	Arctic fox	Arctic regions	5	3
2392	1911	Wild cat ( <i>Felis ruffus</i> )	South Carolina	0	1
2644	1912	Wild cat ( <i>Felis ruffus</i> )	South Carolina	7	13
3037	1913	Sea lion	California	56	42
3221	1914	Swift fox	Western United States	0	4
3293	1914	Wild cat ( <i>Felis ruffus texensis</i> )	North Mexico and Texas	11	10
3297	1914	Wild cat ( <i>Felis ruffus texensis</i> )	North Mexico and Texas	10	14
3298	1914	Wild cat ( <i>Felis ruffus texensis</i> )	North Mexico and Texas	4	3
3306	1914	Red fox	North America, Eastern United States	1	1
3561	1915	Wild cat ( <i>Felis ruffus</i> )	South Carolina	0	1



- (29) SEURAT (L.-G.). *Sur les premiers stades évolutifs des Spiroptères.* [The First Stages of Development of the Spiroptera.]—*C. R. Soc. Biol.* 1915. Nov. 19. Vol. 78. No. 17. pp. 561–565. With 5 text-figs.

In this paper the author traces the changes passed through by the larvae of certain Spiroptera in the intermediate host.

The coprophagous Coleoptera frequently contain in their body-cavities larval nematodes enclosed in capsules produced by a proliferation of the epithelium.

These are sometimes present in very large numbers. The larger capsules contain a larva 3 or 4 mm. in length, which is that of the Spiroptera of the dog. The smallest capsules contain one or more larvae which vary in length from .9 to 1.7 mm. in length and are characterised by a long tubular buccal cavity and two asymmetrical cervical papillae. This parasite the author believes to be *Physocephalus sexalatus*, which is apparently the same as that imperfectly described by LINSTOW as *Spiroptera (Filaria) strigis*.

These two larvae closely resemble each other, and a special feature of the resemblance is the possession of a prominent ventral and dorsal lip to the mouth, and the termination of the tail in a rounded button furnished with points. They also possess two lateral cervical papillae which may be placed symmetrically or asymmetrically. They also show two asymmetrical papillae on the upper border of the lateral areas in the region of the intestine.

In addition to these encapsuled forms free larvae are found.

The eggs of the Spiroptera of the dog and of *Physocephalus sexalatus* hatched out on a hollow slide produce larvae about 130 microns in length, the anterior extremity of which is blunt and armed with a short projection for the purpose of perforating, and the tail is conical.

The larvae of the first stage are 420 microns in length and about one-tenth of that in thickness. The head is rounded and carries a short boring apparatus. The tail is short and bluntly conical. On the ventral surface about the anterior fourth of the length of the body there is a pear-shaped vesicle with an excretory pore. The larvae in this stage are of particular interest as they are on the point of undergoing their first moult.

The larvae of the second stage are likewise free in the abdominal cavity of their host and only become encapsuled after the second moult. A large and a smaller parasite have been found, which the author thinks are *Spirocercus sanguinolenta* and *Physocephalus sexalatus* respectively. The larva of the second stage of the latter parasite is relatively slender, the head is rounded and the tail rounded and quite smooth. The excretory pore opens about 77 microns from the anterior extremity at the summit of a slight cuticular elevation. The anus has a prominent posterior lip. The buccal cavity measures 28 microns, and the oesophagus is about one-third the length of the body. The rudimentary genital apparatus is represented by an ovoid undifferentiated cellular structure applied to the ventral face of the intestine about the mid-point of its length.

The larvae of *Ph. sexalatus* when they measure about 0.8 mm. have reached their maximum development and are ready to undergo their second moult. In the cephalic extremity the head of the larva of the

third stage can be seen with its two dorsal and ventral lips, and the narrow tabular buccal cavity. At the caudal extremity the truncated end with a rounded boss covered with spicules can be made out. The second-stage larva only undergoes a second moult after encapsulation.

The second-stage larva of *Sp. sanguinolenta* closely resembles that just described, but is larger, the buccal cavity is more spacious, its walls are thicker, and the nerve ring occupies a more posterior position.

(30) LEIPER (R. T.). **Report on the Results of the Bilharzia Mission in Egypt, 1915. Part III.**—*Jl. Roy. Army Med. Corps.* 1915, Sept. Vol. 25. No. 3. pp. 253–267. With 3 plates & 5 text-figs.

In this portion of the report the author deals with the development in the intermediary host, the penetration of the definitive host, and the development of the parasite in the definitive host.

The life-cycle of the digenetic trematodes may be concisely expressed by the scheme which the author gives (see page 29).

In the case of Bilharzia the development in the intermediate host is as follows :—The miracidium gives rise to a sporocyst which in turn gives rise to daughter-sporocysts. These migrate into the digestive gland and grow rapidly, becoming elongated and ramifying throughout the organ, which becomes greatly atrophied.

The sporocysts are not provided with any alimentary canal and absorb their nutriment through their delicate wall. They are capable of executing wriggling movements. The cercariae, which develop in the interior of the sporocysts, make their escape through rents in the wall.

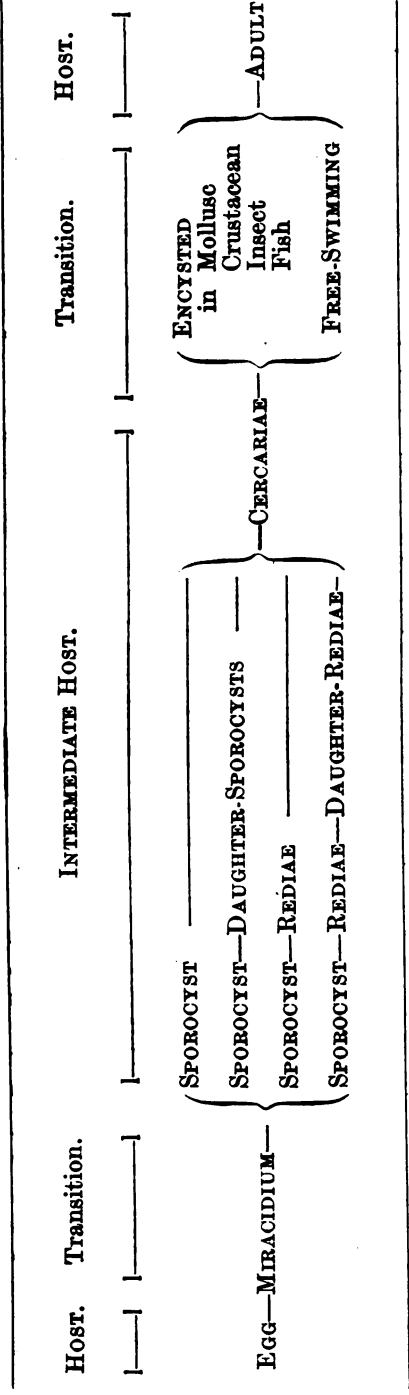
The cercaria comprises a body which is an undeveloped adult and a tail which is purely larval. They possess digestive, excretory, and genital systems and oral and ventral suckers. It is by these characters that the cercariae may be classified.

One of the most characteristic features of the Bilharzia cercariae is the presence of a tail which shows a terminal bifurcation. This feature is possessed by two divisions of distomes, the lophocerca and the furcocerca. Bilharzia belongs to the latter of these groups as it possesses a well developed ventral sucker.

The proof of actual penetration of the cercariae through the skin was furnished by suspending a young mouse in a test tube containing water full of cercariae for half an hour, and examining paraffin sections from the animal embedded whole. When the mouse was removed from the water only a few cercariae remained, and a large number of detached tails were found. The sections showed that the cercariae actually penetrated the skin, and did not enter the tissues by way of the hair follicles or pores. The warmth of the body seemed to be attractive to the cercariae, as very little evidence of penetration was obtained when a dead mouse was used.

After penetration of the definitive host there is no metamorphosis, development being simply a matter of growth and differentiation of organs and sexes. A plate gives illustrations of the various stages of development from the moment of penetration of the cercaria up to the complete development of the male and female, which requires a period of about two months.

LIFE-CYCLE OF A DIGENETIC TREMATODE. [LEIPER (R. T.)]



It is not yet certainly known by what path the parasite reaches the portal system, but it is definitely ascertained that all the cercariae do not reach the liver at the same time. It is probable that some pass direct into the blood stream, while others pass first through the lymphatic system.

- (31) RANSOM (B. H.) & HALL (M. C.). *The Life-History of Gongylonema scutatum*.—*Jl. of Parasitol.* 1915. Dec. Vol. 2. No. 2. pp. 80–86.

The authors' summary is as follows:—

“The eggs of *Gongylonema scutatum* present in the faeces of sheep and cattle infested with the adult parasite, hatch out when swallowed by insects of various species.

“The larvae thus released from the eggs, pass into the body cavity and reach the final larval stage in about a month. In this stage the larva is coiled into a spiral and is enclosed in a capsule about half a millimeter in diameter. The length of the fully developed larva is about 2 mm. and the oesophagus equals about two-thirds the body length. The mouth, elongated dorso-ventrally, is surrounded by a flange-like chitinous border.

“Sheep fed upon insects containing these larvae became infested with *Gongylonema*. A hog fed upon croton bugs artificially infested by feeding with eggs of *Gongylonema* from cattle failed to become infested. A mouse, rabbit, and guinea-pig fed with *Gongylonema* larvae from beetles found in sheep manure, or from croton bugs artificially infested by feeding *Gongylonema* eggs from cattle, also failed to become infested. Failure to produce infestation in these various animals indicates that the *Gongylonema* of sheep and cattle (*G. scutatum*) is not transmissible to hogs, mice, rabbits, or guinea-pigs.

“*Gongylonema* larvae have been found in various species of dung beetles collected from sheep manure, namely, *Aphodius femoralis*, *A. granarius*, *A. fimentarius*, *A. coloradensis*, *A. vittatus*, *Onthophagus hecate*, and *O. pennsylvanicus*. They have been developed in various species of *Aphodius* and in croton bugs (*Ectobia germanica*) by feeding the eggs of the *Gongylonema scutatum* from cattle. The feeding of eggs of *Gongylonema* from the gullet of a hog (presumably *G. pulchrum*) to croton bugs also resulted in the development of encysted larvae.

“Under natural conditions the usual intermediate hosts of *Gongylonema scutatum* are probably dung beetles of various species.

“The life history of *G. scutatum* is similar to that of *G. neoplasticum* of rats, mice, and other rodents, the intermediate stage of the latter having been found by Fibiger and Ditlevsen to develop in roaches (*Periplaneta americana*, *P. orientalis*, and *Ectobia germanica*) and in a beetle (*Tenebrio molitor*). It is also similar to that of another rat and mouse parasite, *Spiroptera obtusa*, whose intermediate host was found by Leuckart and Marchi to be the larva of a beetle (*Tenebrio molitor*).”

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## BITING FLIES, ETC.

- (32) RODHAIN (J.) & BEQUAERT (J.). **Sur quelques Oestrides du Congo.** [The Oestridae of the Congo.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 687-695.

In this paper the authors revise in the light of recent discoveries the classification of the African Oestrinae which they published in 1913\*. In addition to the introduction of the new genus *Kirkioestrus* (*Kirkia* Gedoelst), they have included the *Cephenomyia* Latr. and the *Pharyngomyia* (Schiner).

- (33) RODHAIN (J.) & BEQUAERT (J.). **Sur quelques Oestrides du Congo.** [Some Oestridae of the Congo.]—*Bull. Soc. Path. Exot.* 1915. Dec. Vol. 8. No. 10. pp. 765-778.

Four species of Oestridae have been discovered in elephants in the Belgian Congo. Two of these occur in the stomach, one in the oesophagus, and one in the sole of the foot.

The species found in the foot is *Neocuterebra squamosa* Grunberg, and it is found in the adipose tissue of the sole, or partly in the thickened dermal layer. This species is very scarce and all attempts to obtain the mature insect have failed.

The larvae are oval in shape and biconvex. They are very slightly fattened from above to below. There are neither intermediate zones nor lateral prominences. The two cephalic segments are fused, making 11 segments in all. Both surfaces show a number of regularly arranged rounded or toothed chitinous scales. The pseudocephalon is retracted into the third segment and provided with two small buccal hooks, and two antennary papillae. The anal segment is very small, and completely retracted into a deep depression in the preceding segment. The posterior stigmatic plates are oval and enclosed in a deep hollow in the anal segment.

The parasite varies in length from 17 to 21 mm. and from 8 to 11 in width.

The oesophageal parasite is very common and belongs to the species *Pharyngoglobus africanus* Brauer. It is found attached to the wall of the oesophagus close to the cardia. The authors have been able to obtain pupae in fresh faeces, and attention is drawn to the fact that the larvae mature in the oesophagus and are passed through the intestine and pupate in the soil.

In the third stage they measure from 25 to 29 mm. in length and from 10 to 11 in width. The body is slightly flatter on its ventral than on its dorsal face, and the posterior extremity is about the same width as the anterior. The antennal swellings are widely separated at their bases and each is furnished with three ocelliform projections. The anal segment is rounded posteriorly and the stigmatic cavity is very deep. The latter is open to the exterior through a small aperture bounded by two lips which are in contact. The pre-anal swelling is well developed, but shows no transverse groove. There are numerous

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\* *Rev. Zoolog. Africa.* Vol. 2. No. 2. p. 182.

rings of spines, but there are no groups on the ventral surface. There are complete rings of spines which are composed of alternating large and small ones.

The anterior stigmata are well developed and appear as thickened chitinous knobs. The posterior stigmatic plates are semilunar in outline and show numerous false apertures.

In the second stage the larvae are scarcely different from those in the third stage except for their smaller size.

The pupae which the authors have been able to obtain from larvae evacuated naturally measured about 15 mm. by 8 mm. When viewed from below their outline was practically oval. The dorsal surface was markedly convex and slightly swollen behind the middle point. The ventral surface was almost flat.

From 20 to 21 days were required for the development of the nymph.

In a previous communication the authors included these parasites with the *Cephenomyia*, *Pharyngomyia*, and *Aulacephala*, but having had the opportunity of examining specimens of the first two they are now of the opinion that they should be grouped with the *Calliphorinae*.

Gastric larvae appear to be very common in elephants, and the authors have found two distinct types, types so different that they are almost inclined to place them in two separate genera.

One of the parasites found, of which the authors have been able to obtain the hitherto undescribed perfect insect, appears to be *Cobboldia loxodontis* Brauer.

Details are given of the characteristics of the male and female imagines, and attention is drawn to the fact that though they closely resemble *Cobboldia elephantis* there are certain points of difference serving to distinguish them.

The larvae in the third stage measure from 20 to 22 mm. in length by about 8 mm. at the widest part. The five anterior rings gradually taper to the cephalic extremity, but the posterior rings are more constant in size, with the exception of the last which is far narrower than the immediately preceding one.

The body is biconvex and there are no intermediate zones on either surface. On each side there are three deep longitudinal grooves between which on each ring from the second to the eleventh there is an upper and a lower prominence. On the second, third, and fourth segment there is often a third smaller projection.

As in the case of *C. elephantis* Steel there are no conical lateral swellings on the seventh to the eleventh segments.

The posterior stigmatic plates are placed very close together on the upper surface of the anal cavity so that they are scarcely visible from the exterior. They are oval in shape.

On the dorsal surface spines are present along the anterior borders of the segments only. On the ventral surface the segments show an increasing number of rows of spines to the sixth and seventh segments where there are four rows, and posterior to this they decrease in number again. On the sides of the body fusiform intermediate areas from the third to the eighth segment show groups of spines. There are two or three rows of small spines on the anal segment above the stigmatic plates, and the lower lip of the orifice shows above the conical prominences two swellings crowded with spines.

The duration of nymphosis is 19 to 20 days. The pupa closely resembles that of *Cobboldia chrysidiformis*, and differs only from it in details of the disposition of the spines, and the rather larger size.

*Cobboldia chrysidiformis* n. sp.

Full details are given of the male and female flies, and special attention is drawn to the fact that this fly presents an appearance so different from the other members of the genus that the authors were inclined at first to make a new genus for it. They bear a striking resemblance to Chrysudes family of the hymenoptera both in respect to their general form and their brilliant greenish-blue metallic lustre.

The larvae in the third stage are of a dirty white colour and measure from 14 to 15 mm. in length by about half that at the widest part.

On the lateral swellings from the eighth to the eleventh segment there are conical papilla-like projections, and on the seventh segment there may be a very small projection corresponding with these.

The two segments of the pseudo-cephalon resemble those of *C. loxodontis*, and, as in that parasite, the anal segment carries three pairs of conical papillae. The general arrangement of the spines is very similar to that of *C. loxodontis*, but the spines are far less numerous.

The colour of the pupae is a glistening brownish-black. The anal segment is completely retracted into the preceding one. The anterior stigmata appear as two brownish-yellow swellings mounted on a short peduncle. The swollen extremity is surrounded by a complete circle of twelve small papillae.

The pupae measure from 13 to 15 mm. in length by 5 in width.

The classification of the genus *Cobboldia* is discussed.

- (31) JOYEUX (Ch.). **Sur quelques Arthropodes récoltés en Haute-Guinée française.** [Some Arthropods collected in Upper French Guinea.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 656-659.

The larvae of *Amblyomma variegatum* are very numerous from November to February, and they attach themselves to man and animals. They commence to drop off at about the 12th hour, and continue to do so until the third day. The nymphs also attach themselves to man but to nothing like the same extent. The author has seen only one clear case of parasitism with the adults.

*Dermanyssus gallinae* and *D. hirudinis* are both common.

*Hippobosca maculata* Leach is common, and bites all species of domesticated animals, but the author has never observed it to bite man. The whitish pupa of this fly becomes black within 24 hours and hatching occurs in from 23 to 30 days.

Along the banks of the Niger and its tributaries the author has found both *G. morsitans* and *G. palpalis* in the proportion of two of the former to 52 of the latter.

The following mosquitoes have been obtained:—*Culiciomyia nebulosa*, *Culex duttoni*, *Pyretophorus costalis*, *Myzomyia funesta*, *Cyathomyia fusca*, *Stegomyia calopus*, *Toxorhynchites brevipalpis*.

Myiasis has been observed once in the human subject and seven times in animals, the latter cases being due to *Chrysomyia megacephala*. The female of this species lays about 90 eggs on the skin, and after an

interval of 18 to 24 hours, the larvae penetrate into the subcutaneous connective tissue and there complete their development. Necrosis of the skin results, and the adult larva drops to the ground, where it pupates.

In addition to the bovine animals already recorded by ROVERE as being attacked by this fly, the author has observed two cases in horses. The usual position of the lesions in cattle is about the mammary gland, and in the male about the scrotum, but the author has seen them in wounds of the dewlap of a zebu, and the base of the horn in an ox. In the horse the lesions are generally around the fetlock or near the frog.

*Cordylobia anthropophaga* is frequently a parasite of dogs and monkeys.

In one instance the author found a very severe infestation with *Gastrophilus nasalis* in the duodenum of a mule.

(35) NUTTALL (G. H. F.). Ticks of the Belgian Congo and the Diseases they convey.—*Bull. Entom. Research*. 1916. Feb. Vol. 6. No. 4. pp. 313-352. With 48 text-figs.

In this paper the following subjects are dealt with: The classification of ticks, together with a short illustrated account of the species occurring in the Congo; The general biology of ticks; The special biology of the Congo ticks and their relation to disease. The concluding pages give information on the following points: How to collect ticks and what to observe; How to raise ticks; and an Index to the Congo ticks and their hosts.

The following tabular statement regarding the ticks is included:—

INDEX TO CONGO TICKS AND THEIR HOSTS.

	Hosts. †
<i>Amblyomma cohaerens</i> , Dönitz 1909 ..	cattle, buffalo.
* ,, <i>hebraeum</i> , Koch 1844 ..	cattle, sheep, goat, antelope.
,, <i>marmoreum</i> , Koch 1844 ..	rhinoceros, Genetta, Chelonia, python.
,, <i>pomposum</i> , Dönitz 1909 ..	cattle, mule, antelope.
,, <i>splendidum</i> , Giebel 1877 ..	cattle, buffalo.
,, <i>tholloni</i> , Neumann 1899 ..	elephant, horse, antelope.
,, <i>trimaculatum</i> , Neumann 1908 ..	lizards.
,, <i>variegatum</i> (Fabricius 1794)	cattle, sheep, rhinoceros.
<i>Aponomma exornatum</i> , Koch 1844 ..	reptiles.
,, <i>laeve</i> , Neumann 1899 ..	reptiles.
* <i>Boophilus decoloratus</i> (Koch 1844) ..	cattle, sheep, goat.
<i>Dermacentor circumguttatus</i> , Neumann 1897 ..	elephant.
,, <i>rhinocerotis</i> (de Geer 1778) ..	rhinoceros.
* <i>Haemaphysalis leachi</i> (Audouin 1827) ..	Carnivora, cattle, sheep, goat, horse.
,, <i>parmata</i> , Neumann 1905	cattle, goat, sheep, buffalo, antelope, dog, Potamochoerus.
† <i>Hyalomma aegyptium</i> (Linnaeus 1746) ..	cattle, sheep, etc., dog.

\* See note at end of Index.



## INDEX TO CONGO TICKS—cont.

	Hosts.†
<i>Ixodes rarus</i> , Neumann 1899 .. ..	cattle, dog, leopard, Hyrax.
„ <i>rubicundus</i> var. <i>limbatus</i> , Neumann 1908 .. ..	sheep, goat.
* <i>Ornithodoros moubata</i> (Murray 1877) ..	man.
<i>Rhipicentor bicornis</i> , Nuttall and Warburton 1908 .. ..	horse, goat.
* <i>Rhipicephalus appendiculatus</i> , Neumann 1901 .. ..	cattle, sheep, goat, horse.
* „ <i>capensis</i> , Koch 1844 .. ..	cattle, antelope, pig.
* „ <i>evertsi</i> , Neumann 1897 .. ..	cattle, horse.
„ <i>evertsi</i> var. <i>albigeniculatus</i> , Warburton 1915 (n. var.) ..	cattle.
„ <i>falcatus</i> , Neumann 1908..	cattle, goat, dog.
„ <i>lunulatus</i> , Neumann 1907 .. ..	cattle, sheep, goat, antelope, dog.
* „ <i>sanguineus</i> (Latreille 1804) ..	dog, sheep, goat.
* „ <i>simus</i> , Koch 1844 .. ..	cattle.
„ <i>supertritus</i> , Neumann 1907 ..	cattle.
„ <i>tricuspis</i> , Dönitz 1906 .. ..	rabbit.

\* Denotes species which convey diseases and whose life-histories are described in the text.

† Names in italics are those of hosts from which we have received most specimens.

‡ Life-history described in the text.

(36) BISHOPP (F. C.) & LAAKE (E. W.). A Preliminary Statement regarding Wool Maggots of Sheep in the United States.—*Jl. Economic Entomol.* 1915. Vol. 8. No. 5. pp. 466-474.

As yet the species of flies responsible for this injury to the wool in the United States have not been definitely ascertained, but it is believed that *Lucilia sericata* and *L. caesar* are responsible, at least in part.

In parts of Texas two types of injury to the wool are observed. The first of these occurs in ewes just after lambing, which takes place in March and April. In this case the infestation is confined to the rump. In the other type of injury the process starts about the base of the horns in rams, the infestation being favoured by the presence of small wounds in this situation, which are caused by fighting.

Formerly the flies appeared to blow only soiled wool, but during recent years they appear to have acquired the habit of attacking all classes of sheep, clean or otherwise.

In Texas the authors have found that the common black blow-fly is responsible for these attacks during the spring.

The infestations which occur in Texas during the late summer are probably due to *L. sericata*.

*Phormia regina*, the black blow-fly, is found throughout the United States, but its seasonal distribution varies according to the temperature. In the southern parts it is most plentiful in the spring, but is active through the winter except for a few days during the cold period. It disappears during the hot weather. In the more northern parts the season is during the summer.

The fly breeds almost exclusively in animal matter, especially if it is in a decaying condition, and it appears to be probable that it is the odour of soiled wool, particularly if blood be present, that attracts the flies to living sheep. It is observed that the flies do not feed on the droppings of herbivorous animals.

Hatching requires from 24 hours to 4 days under experimental conditions, but it is probable that the period is shorter with eggs deposited upon living animals. The larvae complete their development in from 4 to 76 days, and before pupation they generally penetrate into the ground to a depth of three or four inches. The pupal stage last for from three days to a month. The periods are shorter as the temperature rises, but excessively high temperatures appear to hinder breeding.

When caged without food adults have lived from two to eight days. With animal food they have lived for one to three months.

*Lucilia sericata* is observed throughout the Southern States except during the coldest periods. Reproduction does not take place during the winter even in the extreme south, the winter being passed in the larval or pupal stage in the ground. Attempts to keep adults through the winter in cages have not been successful.

While *P. regina* is found on the ranges, *L. sericata* is far more closely associated with human habitations. Garbage of all sorts, and especially damaged fruit, is a favourite food of the adult, but the authors have not succeeded in rearing larvae or even obtaining deposits of eggs on substances other than animal matter.

The adult does not live for more than three days in captivity when starved, and when fed the period of life does not exceed six weeks.

The interval between emergence of the adults to the commencement of egg laying varied from 4 to 21 days. As a rule rather less than 24 hours is the period required for hatching.

As measures for the repression of the condition it is suggested that carcasses should be burnt, or if that be impracticable they should be buried. If they can be buried before they become blown a few inches of soil is sufficient to cover them, but if they are already blown they should be buried to a depth of two feet to prevent the flies from emerging.

The lambing should be done if practicable during the winter, and the flock should be divided into small lots and carefully watched. Every effort should be made to prevent scouring. Hornless breeds should be encouraged.

A hymenopterous parasite, probably *Nasonia brevicornis*, has been found to breed freely in the puparia of a number of carrion flies, and as the period required for the development is short and the reproductive capacity of this parasite is great, it may be looked upon as an important check to fly breeding.

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#### MISCELLANEOUS.

- (37) WEIDMAN (F. D.). An Arachnoid (*Pneumotuber macaci* Landols and Hoepke?) Parasitic in the Lungs of a Monkey (*Macacus rhesus*).—*Jl. Comp. Path. & Therap.* 1915. Dec. Vol. 28. No. 4. pp. 326-330. With 1 text-fig.

In the lungs of a monkey dying from subacute enteritis the author found a number of nodules varying in size from 2 to 5 mm. in diameter. The smaller ones were firm, but the larger ones showed soft centres with indurated edges. In the fresh state they were pink or grey and

contained grey granular material. Under the microscope arachnoids were found in the centre of them. Sections showed that the centres of the lesions were composed of necrotic material surrounded by an ill-defined wall composed of mononuclears and fibroblasts.

From one of these lesions nine parasites were obtained. Eight of these appeared to be females, some of which were ovigerous. Embryos were visible within the eggs.

The full-grown parasites measured about 0.75 mm. in length. The legs terminated in claws.

A full description of the parasite is withheld until the author has had the opportunity of consulting the descriptions given by other authors of similar parasites found in the same situation.

- (38) WEIDMAN (F. D.). *Pneumonyssus foxi*, nov. sp. An Arachnoid Parasite in the Lung of a Monkey (*Macacus rhesus*).—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1. pp. 37–45. With 1 plate comprising 10 figs.

For a short account of the occurrence of this parasite see above.

The females measured rather less than 1 mm. in length by nearly 0.5 mm. in width at the widest part, viz., just behind the posterior pair of legs. None of the internal organs could be made out, but in a few females an egg could be seen, and in some instances the outlines of a folded embryo in the interior of it.

The head is continuous with the body both dorsally and ventrally. There are no eyes. The rostrum projects slightly, is triangular in shape with a rounded apex, and shows on its dorsal surface a wide groove. The hypostome is quadrilateral and shows a slight median anterior marginal peak. A shallow furrow runs along this in which are placed 8 to 13 blunt teeth directed downwards and forwards. The mouth parts are retracted. Full details are given regarding the structure of the legs.

The first pair of legs has two arched dorsal claws, the extremities overhang or touch a pointed ventral projection. The second pair terminates in a short broad caroncle with two strong claws attached to its dorsum internally. The third pair terminates in a manner exactly similar to the second. The hooked caroncles and the hooks on the fourth pair of legs are more slender and elongated than on the preceding pairs.

The cuticle is soft and has an appearance resembling very fine morocco leather; this is especially marked in certain areas.

The vulva lies ventrally in the middle of a transverse ridge joining the fourth coxae. It is longitudinal, fissural, and short, and is flanked by narrow plates. It appears to be continuous above with the posterior angle of a laterally elongated triangular opening. The intestines are indicated by two tortuous black lines which lie longitudinally close to the dorsal cuticle.

A single parasite judged to be a male from its smaller size was discovered. This parasite measured 0.55 by 0.25 mm. There was no vulval orifice, but a special anterior ventral orifice. Otherwise it was very similar in its general features to the females.

The genital orifice is a small circular orifice immediately behind the hypostome. From this a tube leads posteriorly for some distance just under the ventral cuticle.

A larval form was found which appeared to have escaped from a female, close to which it was lying, as a result of rupture of the latter during manipulation. This parasite possessed only six pairs of legs, and was about the same size as the male above referred to.

The parasite appears to be different from the four species occurring in the same situation already described. The classification of the parasite in the genus *Pneumonyssus* is only tentative, and it is pointed out that the position of the genital orifice of the male places the parasite close to, if not in, the *Gamasidae*.

(39) HEALY (D. J.) & GOTT (E. J.). **A Filterable Organism Isolated from the Tissues of Cholera Hogs.**—*Jl. Infect. Dis.* 1916. Jan. Vol. 18. No. 1. pp. 124–127. With 1 plate.

The work reported in the present paper arose out of the discovery by HEALY and SMITH that an extract of mesenteric glands could be used as antigen in complement-fixation reactions. The evidence indicated that the antigen was specific. It is noted that in the original preparation the glands had to remain for at least eight days at 4° C. to allow the antigen to develop, and also that passage of the preparation through a Pasteur-Chamberland F filter removed it. The preparation of glands referred to was originally made in an attempt to isolate a filterable virus from them. Since in these experiments the extract was always passed through the filter immediately after the glands had been ground up with sand and the results were invariably negative, it occurred to Healy that the reason might be that the organisms were present in too small numbers, and that if the extract were allowed to stand at 4° C. to allow of a possible multiplication the subsequent filtration might not completely stop the organism.

The mesenteric glands of some infected pigs were dissected out with sterile precautions and ground up with sand. They then had added to them ten times their weight of 1 per cent. neutral glucose beef broth and were left at 4° C. for five days. During this period active fermentation occurred. The liquid was then passed through a reburnt, tested, sterile F filter, the period required being 40 minutes. The brilliant filtrate was divided between two Erlenmeyer flasks. One of these was placed in a Novy jar and the oxygen exhausted. The other was sealed with paraffin and placed in the air. Both flasks were kept at 4° C.

No growth developed in the flask in the Novy jar. In the other there was visible growth from the fourth day, which continued for about two weeks. This growth took the form of a very fine sediment which was easily disturbed by shaking. The flask which had originally been placed in the Novy jar when sealed with paraffin and placed in the air developed an exactly similar growth from the 7th day. This experiment was repeated three times with the same results.

The authors have found that the organism grows best at 37° C. in extract of mesenteric glands to which 5 per cent. glycerin has been added. Under these conditions there is visible growth after 24 hours and the maximum is reached in about three days. No growth takes place in the absence of oxygen, nor in any of the ordinary culture media. No subcultures have been obtained.

The original extract of the glands is slightly acid in reaction, and this acidity increases with incubation. No growth takes place if the medium be neutralised.

In hanging drop preparations it is seen that the organism is non-motile. It occurs in very small clumps showing many minute bright points. Individual organisms cannot be clearly distinguished.

Ordinary aniline dyes do not give good results, but under proper conditions good results are given by Giemsa.

A three-day culture grown at 37° C. was centrifuged and smears made of the deposit. These were allowed to become dry in the air, and were then fixed in methyl alcohol for an hour, rinsed in distilled water and again air-dried. They were stained with a warm solution of Giemsa containing 50 drops to 50 cc. and accurately neutralised. After staining the preparations were washed in distilled water, air-dried and mounted in xylol balsam. In such a preparation the organisms are clearly seen as minute lilac coloured bodies embedded in a paler lilac coloured material which in the fresh preparations had a gelatinous appearance.

The organism appears to be either a coccus or a very short bacillus about 0·2–0·3 microns in diameter.

(40) GRAHAM (R.) & HIMMELBERGER (L. R.). **The Value of Virulent Salt Solution in the Production of Antihog-cholera Serum by the Intravenous Method.**—*Jl. Infect. Dis.* 1916. Jan. Vol. 18. No. 1. pp. 118–123.

The authors have taken up the work first suggested by CRAIG and ROBBINS of attempting to increase the yield of virus from pigs by injecting normal salt solution into the peritoneal cavity and leaving it there for some hours before slaughter. They have however used the virulent salt solution thus obtained for intravenous injection instead of subcutaneous injection.

They have found that the best results are obtained when 25 cc. per pound body weight of 0·9 per cent. salt solution are injected into the peritoneum five or six hours prior to slaughter, the salt solution being withdrawn with aseptic precautions afterwards.

The amount of blood obtained when this plan is adopted is from 10 to 20 per cent. greater than ordinarily, and from 40 to 70 per cent. of the salt solution injected is recovered.

Salt virus and blood virus were first used for hyperimmunisation in mixtures containing respectively 1, 2, and 3 parts of blood to 3, 2, and 1 part of salt virus. The dose of the mixture was 7 cc. per pound weight.

The sera of these three animals proved to be protective.

Subsequently a number of other mixtures were used, but in general the proportion of blood virus to salt virus was 60 to 40, the dose being 7 cc. per pound body weight. The serum obtained by this procedure was efficient for the protection of pigs against 2 cc. of virus.

It is not contended that the salt virus is as virulent as the blood virus, but it is shown that the mixture is effective for the production of serum, and it is suggested that if a higher concentration of salt solution were introduced into the peritoneal cavity a higher degree of virulence would be acquired by it.

On the basis that a virus pig yields about 10 to 15 cc. of blood per pound body weight, the injection of the salt solution into the peritoneum increases the yield by from 200 to 500 cc. Including the blood virus and the salt virus the total yield of virus is increased from 75 to 80 per cent.

- (41) RAILLIET (A.) & HENRY (A.). **Le parasite de la dermite granuleuse des equidés.** [The Parasite of Granular Dermatitis in Equines.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 695-704. With 3 text-figs.

The authors deal at some length with the evidence upon which they base the conclusion that the parasite present in summer sores does not belong to the genus *Filaria*, but to the Spiroptera, and that it should in reality be classed in the genus *Habronema*.

With regard to the manner in which the embryos gain access to the subcutaneous tissue, the authors are inclined to think that the embryos are passed out from the stomach and reach the exterior with the faeces, and that they penetrate the skin in the same manner as the larvae of the ankylostomes, and that the rubbing due to the irritation thus set up is responsible for the production of the sores.

- (42) CARPANO (M.). **Sulla virulenza del sangue degli animali infetti di peste bovina.** [The Infectivity of the Blood of Animals infected with Rinderpest.]—*La Clinica Veterinaria.* 1915. Dec. 15. Vol. 38. No. 23. pp. 901-915.

As a result of some observations carried out in Eritrea, the author arrives at the conclusion that the blood in cases of rinderpest may not be infective during the stage of the disease that is characterised by symptoms indicating gastro-intestinal disturbance, nor at the time of death.

- (43) ARMPFIELD (J. M.). **Some Important Cattle Diseases in North-West Rhodesia not mentioned in Text-Books.**—*Vet. Jl.* 1915. Dec. Vol. 71. No. 486. pp. 583-584.

The author records the occurrence of a disease somewhat resembling three-day sickness, but differing from that disease in that the animals showed stiffness in the hind limbs for many weeks, and became very emaciated; and also a condition which he terms "posterior paralysis" which has caused losses among imported bulls. The latter disease has only been observed during the last two years. Nothing is known regarding the cause of either of these conditions. In some cases the disease is acute and in others chronic. The author has seen a case terminate fatally in three weeks. Although the disease has been most frequently observed in imported animals, and in cross-breeds, cases have also been seen in native animals.

- (44) BEVAN (Ll. E. W.). **A Simple Method of obtaining Serum for the Agglutination Test from Cattle Suspected to be suffering from Contagious Abortion.**—*Jl. Comp. Path. & Therap.* 1915. Dec. Vol. 28. No. 4. pp. 277-280. With 2 text-figs.

Owing to the difficulties associated with the obtaining of sterile blood under the conditions prevailing on the veldt, a number of tests

were carried out with the object of ascertaining whether any antiseptic mixture could be added to blood to prevent putrefactive changes occurring in it. It was found that a 3 per cent. solution of boracic acid in normal salt solution, when added to the blood in the proportion of one part to five, was quite efficient for this purpose, and that such addition did not render the serum unsuitable for the test.

For the collection of the blood tubes were prepared in the following way:—Pieces of glass tubing three inches long and with a bore of 4 mm. and an external diameter of 6 mm. were drawn out at each end, so that the tapering portions did not exceed one inch in length, and the ends were clean cut. If the tubing was larger than this the capillary attraction was not sufficiently great, and the blood tended to run into the tube and close the opposite end. If the point were too finely tapered the blood tended to coagulate in the point.

In taking the blood the best method was found to be as follows:—

A cut was made on the lower margin of one of the ears, preferably the left, so that the blood flowed too freely to coagulate.

A quantity of the boracic solution was drawn into the pipette the point of which was then applied to the drop of blood on the edge of the ear, the tube being held horizontally.

When the blood has been collected the ends of the tubes are sealed in the flame of a spirit lamp, or if that be not available they may be plugged with sealing wax.

By adopting this method it has been found possible to test every sample sent in to the laboratory, whereas when the blood was withdrawn from the jugular 50 per cent. of the samples had to be rejected owing to contaminations having rendered the blood quite unsuitable for the test.

(45) **BOERNER (F.) Jr. Natural Haemolysins in Normal Horse Serum.—**  
*Jl. Infect. Dis.* 1915. Nov. Vol. 17. No. 3. pp. 497-499.

Conclusions:—

“Of 200 sera examined for antisheep haemolysin, 1·5 per cent. were found capable of producing complete destruction of these cells in the amount of 0·4 cc.

“Horse serum was found to possess the property of dissolving the red cells of the dog without the aid of complement.

“Native haemolysins for the cells of the guinea-pig, hog, goat, cat, white mouse, rabbit, chicken, and man were not found.”

(46) **KOLMER (J. A.), TRIST (M. E.) & HEIST (G. D.). Complement Fixation in Intestinal Parasitism of Dogs.—**  
*Jl. Infect. Dis.* 1916. Jan. Vol. 18. No. 1. pp. 88-105.

The authors were induced to carry out the investigations described in this paper by the fact that in superficial diseased conditions such as ringworm positive complement fixation tests can be obtained. Dogs were selected on account of the abundance of material available, and the possibility of controlling the results by post-mortem examination.

As antigens extracts in salt solution and alcohol were prepared from various worms that are frequent inhabitants of the intestine of the dog. In addition to these an extract of *Strongylus gigas* was also used.

The salt solution extracts were prepared by grinding up 4 grams of washed parasites with sand and powdered glass and suspending the resulting material in 100 cc. of salt solution containing 0.5 per cent. carbolic acid. The mixture was shaken for 24 hours in a shaker, incubated for several days at 37° C., and then filtered and stored. These extracts were found to be rather variable and to require titration before every experiment, as the anti-complementary units present varied considerably.

The alcoholic extracts were made with absolute alcohol in the same manner, except that the incubation was continued for a longer time.

One of the difficulties encountered in the course of the observations was the frequent occurrence of non-specific complement fixation. The sera were therefore generally used in both the active and inactivated state. The dose was generally about 0.1 cc.

Another difficulty was the impossibility of ascertaining the duration of the infestation, and the difficulty of excluding infestations on the basis of a single or multiple negative examination of the faeces. It is unsettled whether antibodies persist in the body after the expulsion of the parasites.

Tabular statements of the tests carried out with various extracts are given, the results of which are also summarised.

Tests were made with serum from 172 dogs, but in 62 instances proper examination of the faeces could not be carried out.

From these the following information may be gained :—

Of 36 dogs, the sera of 10 gave positive results with salt solution extracts of *Ascaris canis*. The sera of only two of these dogs gave positive results with alcoholic extracts of the same parasite. Positive results were obtained with alcoholic extracts of *Ascaris lumbricoides* in the case of 11 dogs, and of these five had given negative results with the two extracts of *Ascaris canis*.

In five dogs which were infested with *T. serrata* three yielded positive results with the salt solution antigen, and four with the alcoholic extract antigen. None of these reacted to an alcoholic antigen prepared from *T. saginata*, but four dogs infested with *Dipylidium caninum* gave positive results.

Thirty-four dogs infested with *Trichocephalus dispar* were tested with salt solution extracts, but the result was negative in each case. Sufficient parasites were not available for the preparation of an alcoholic extract.

In a considerable number of cases positive results were obtained with sera from dogs in whose faeces no ova could be discovered. The tabular statement of these tests does not include those in which the serum control tube showed an anticomplementary state of the serum.

In a previous paper the authors have shown that inactivating normal rabbit and dog serum by heating to 56° C. for half an hour greatly increases the antilytic activity and the percentage of non-specific complement fixations. But heating to 62° C. tends to remove a large amount of the non-specific antilytic complement fixing substances without materially decreasing the amount of antibody.



In general it appeared that a higher percentage of positive results was obtained when alcoholic extracts were used than when salt solution extracts were employed, and that tapeworms were more likely to give rise to antibodies than round worms. It would further appear that the antibodies are not highly specific.

Experiments in which descending doses of serum were used showed that the tapeworms and the round worms produced antibodies almost specific for themselves, but not highly specific for different worms belonging to these groups.

Very similar results were obtained when rabbits were immunised with extracts of the parasites, and their sera tested with homologous and heterologous antigens.

- (47) SARTORY (A.). *Présence du Sporotrichum beurmanni de Beurm. et Goug. sur un épi de blé.* [The Presence of *Sporotrichum beurmanni* on an Ear of Corn.]—*C. R. Soc. Biol.* 1915. Dec. 31. Vol. 78. No. 20. pp. 740-742.

The author cultivated the parasite from an ear of corn which was thought to be infected with rust.

Cultures were obtained in the first instance on simple agar and on Sabouraud's peptonised glucose agar. A mycelium composed of segmented filaments 2 microns in diameter developed in a week. Conidia were present along the sides and at the extremities of the filaments and the side branches. The spores were pyriform and attached to the filaments by very slender pedicles. They measured from 3 to 6 microns in length and from 2 to 4 in breadth. When mature they were oval in shape.

The colonies on Sabouraud's medium presented the typical wrinkled appearance on the surface, and gradually changed in colour from white to coffee coloured and then to a brown black.

The parasite was cultivated on glycerinised potato and carrot, the latter acidified with 3 per mille tartaric acid, peptone agar, broth, glucose broth, glucose gelatin, coagulated serum, milk, starch, white of egg, haemoglobin, urea, ammoniacal salts, and peptone water.

There was no transformation of starch into dextrin, no liquefaction of the egg-white, no fermentation of the urea, nor alteration in nitrates and nitrites. Gelatin was liquefied, and there was no formation of indol. Glucose, galactose, lévulose, saccharose, and maltose were fermented, but lactose, dulcitol, and mannitol were not.

Passage of the parasite through the rat exalted its virulence and eventually the organism produced a rapidly fatal septicaemia. Agglutinins and antibodies could be detected in the blood, and positive complement fixation results were obtained.

The author refers to GOUGEROT's discovery of the parasite on plants in the Alps.

- (48) MARIN & HENRY. *Le charbon bactérien dans le region de Constantine.* [Anthrax in the Neighbourhood of Constantine.]—*Bull. Soc. Path. Exot.* 1916. Feb. Vol. 9. No. 2. pp. 79-81.

In this short paper the authors draw attention to the occurrence of atypical cases of anthrax among bovine animals. In some instances outbreaks of the disease have occurred, but other isolated cases have

been encountered. In some of these cases a diagnosis would not have been made unless microscopic examination had been resorted to on account of the absence of symptoms and the usual lesions. Cases have come under observation in which the spleen was practically normal in size and colour, and in others the blood appeared to be partially coagulated. It was only after the carcass had been skinned that blood-stained exudates were found in the subcutaneous tissue and between the muscles. In two animals the only lesions were haemorrhagic mediastinal glands.

Diagnosis has been established in these cases by microscopic examination and by cultivation.

These facts emphasise the importance of very careful inspection of meat.

The authors have not observed any cases of the disease in animals other than of the bovine species, and the majority of cases have occurred in animals imported from France, or among the progeny of such animals crossed with local breeds. The indigenous cattle are not immune.

In three outbreaks protective serum obtained from the Pasteur Institute at Paris has been used with exceedingly good results. During 1915 vaccination was employed on a large scale and a few cases have been observed among unvaccinated animals only.

In no case has the vaccination been responsible for death.

- (49) CONREUR (Charles). *Cachexia ossea dos equideos—Cachexia vermiformis dos equideos—Cylicostomose*. (Vulgarmente, no Brasil : *Cara inchada*). [Osseous Cachexia of Horses—Verminous Cachexia of Horses—Cylicostomosis. Vulgarly called in Brazil, Swollen Face.]—*Arch. Brasileiros de Med.* 1915. Aug. Vol. 5. No. 8. pp. 323–348.

By the above names the author distinguishes a disease of horses which is in his opinion due to the presence of the intestinal worm, *Cylicostomum tetracanthum*. It occurs throughout Brazil from north to south, where it chiefly affects young horses imported from Europe, especially thoroughbreds. It has been already described by GERMAIN, CAROUGEAU and others as occurring in Tonkin, Madagascar and other tropical localities, and its presence in Brazil was first noted by LUTZ in 1910. [The author gives no references to the literature of the subject.]

The author having had the opportunity of making numerous post-mortems on horses dead of this disease has found in all of them the intestinal worm already mentioned, and therefore attributes the symptoms to its presence. The disease is common in racing stables near Rio de Janeiro, where young imported thoroughbreds are trained. The ova of the worm can be found in the faeces, and the manure from these stables is often spread on grass land, which is then mowed for hay or green fodder. The disease is thus propagated. The animals present a gradually increasing cachexia followed by fragility of the bones, which results in numerous spontaneous fractures necessitating slaughter. In the final stages the maxillary bones are attacked by a rarifying osteoporosis, accompanied by swelling, to which the vulgar name of "Swollen face" is applied. The author scouts the idea that

this cachexia is in any way due to malnutrition, or to deficiency of lime in the soil, because cattle and sheep pastured on the same ground are totally exempt from the disease, and moreover do not present signs of rickets.

Regarding the disease as due to the action of a toxin on the haemopoietic system, the author recommends the internal use of arsenical preparations, and accordingly, has tried cacodylate of sodium, arrhenal, atoxyl and salvarsan in doses ranging from 60 to 120 centigrammes given intravenously two or three times a week, for from four to eight consecutive weeks. As a vermifuge, the author recommends for young horses from one to two years old the following bolus :—

Thymol .. .. .	6 grammes.
Santonin .. .. .	50 centigrammes.
Aloes .. .. .	6 grammes.
Hard soap, sufficient to form a bolus.	
S. One to be given every two to four days.	

For a horse from two to three years of age, the dose should be increased by 50 per cent., and for one over three years, by 100 per cent. The dose should be repeated till three or four have been given.

The author believes that he has obtained excellent results from this treatment with horses in the early stages of the malady, some of them having been able to win races within two months of the cessation of treatment. As a preventative, the burning of all manure from infected horses, or its burial in cultivated soil, is advised, instead of allowing it to be spread on grass land.\*

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## REPORTS.

(50) PUNJAB. *Annual Report of the Camel Specialist.* [Cross (H. E.).] 21 pp. 1915. Lahore: Superintendent, Government Printing. [Price 2*d.*]

In connection with the question as to whether other animals are susceptible to camel surra only a small number of experiments could be carried out, on account of pressure of other work. The results appeared to indicate that dogs are susceptible, but goats insusceptible. One experiment was carried out in which the camel strain was passed through a pony and then again inoculated into a camel. This single result appeared to indicate that passage through a pony attenuates the virus for the camel.

Treatment.—Sixty-eight animals were treated by the “arsenic alone” method or by the “arsenic and soamin” method. Of these 54 were reported as cured and 14 died.

Experiments in the treatment of the disease have been or are being carried out. Iodine, carbolic acid, sodium bicarbonate, potassium permanganate and borax have been tried, but no good results have been obtained with any of them.

With a view to protecting camels from the bites of blood-sucking flies a number of investigations were made into the properties possessed by various substances for this purpose.

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\* Summarised by Dr. J. B. NIAS.

The conclusion arrived at was that the only emulsion that was of any use was one of chirpine oil in the proportion of 20 to 40 ounces to a gallon of water. The amount sprayed on each camel should be about four pints. Even this emulsion was not of any great value from a practical point of view as it was efficient for only about three hours. If the emulsion was made with 80 ounces of the oil to two gallons it was found that blistering of the skin resulted.

Inspection of castrated camels indicated that those castrated at seven years and upwards were much better animals than those operated upon earlier.

Experiments showed that the best purgative for camels is magnesium sulphate, the dose being from  $1\frac{1}{2}$  to 2 pounds. Next in order with the doses are: Kamala, 8 ozs.; croton oil,  $3\frac{1}{2}$  drachms; aloes,  $3\frac{1}{2}$  ozs. of solution; gamboge, 3 ozs.; and linseed oil, 4 pints. Two grain doses of eserine and pilocarpine given subcutaneously give satisfactory results.

(51) GOLD COAST. Annual Report of the Veterinary Department. 1914. [BEAL (W. P. B.)] 18 pp. With a map, 3 plates & 1 chart. 1915. London: Waterlow & Sons, Ltd.

Trypanosomiasis.—The disease caused in equines by *T. cazalbouri* is less serious than that due to *T. pecaudi*. In many cases of infection by the former parasite there are no clinical symptoms save dullness and elevation of temperature. In the disease produced by *T. pecaudi* there is swelling along the belly and oedema of the sheath and testicles. Filling of the legs and enlargement of the submaxillary glands are more marked in cases of *pecaudi* infection.

In the case of cattle similar effects are seen, the *cazalbouri* infection being far less severe than the infection with *T. pecaudi*. It is said that cattle under good conditions infected with the former parasite may show no evidence of ill health.

Beal has come to the conclusion that *T. nanum* is identical with the trypanosome which he refers to as *T. cazalbouri*.

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## RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 3, No. 4, pp. 163-164.]

**Leishmaniasis.**

- (52) ARAVANDINOS (A.). Contribution à l'histoire de la leishmaniose interne. [The History of Internal Leishmaniasis.]—*Bull. Soc. Path. Exot.*, 1916. Jan. Vol. 9. No. 1, pp. 10-13.
- (53) LOW (G. C.). A Case of Oriental Sore treated by Antimonium tartaratum (Tartar Emetic) locally.—*Jl. Trop. Med. & Hyg.*, 1915. Nov. 15. Vol. 18. No. 22, pp. 258-260.

**Spirochaetosis.**

- (54) LURIE (G. A.). Notes on Castellani's "Broncho-Spirochaetosis," with Report of a Case.—*Jl. Trop. Med. & Hyg.*, 1915. Dec. 1. Vol. 18. No. 23, pp. 269-271. With 1 text-fig.

**Trypanosomiasis.**

- (55) GREGGIO Rd. S. J. (P. G.). La Trypanose humaine et la Natalité infantile dans la région de Kisantu (Moyen Congo Belge).—Influence du traitement atoxylé. [Human Trypanosomiasis and the Birth-rate in the Kisantu District, Middle Belgian Congo.—The Effects of the Atoxyl Treatment].—*Bull. Soc. Path. Exot.*, 1915. Dec. Vol. 8. No. 10, pp. 752-764.

**Biting Flies and Ticks.**

- (56) BISHOPP (F. C.). Flies which cause Myiasis in Man and Animals—Some Aspects of the Problem.—*Jl. Econom. Entomol.*, 1915. June. Vol. 8. No. 3, pp. 317-329.
- (57) CHIDESTER (F. E.). Sarcophagid Larvae from the Painted Turtle.—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1. pp. 48-49. With 2 text-figs.
- (58) CHRISTOPHERS (S. R.). The Pilotaxy of Anopheles.—*Indian Jl. Med. Research*, 1915. Oct. Vol. 3. No. 2, pp. 362-370. With 1 plate.
- (59) CHRISTOPHERS (S. R.). The Male Genitalia of Anopheles.—*Indian Jl. Med. Research*, 1915. Oct. Vol. 3. No. 2, pp. 371-394. With 6 plates comprising 36 figs.
- (60) EDWARDS (F. W.). Eight New Mosquitos in the British Museum Collection.—*Bull. Entom. Research*, 1916. Feb. Vol. 6. No. 4, pp. 357-364. With 5 text-figs.
- (61) KNAB (F.). Some New Neotropical Simuliidae.—*Bull. Entom. Research*. 1915. Dec. Vol. 6. No. 3, pp. 279-282.
- (62) LAMBORN (W. A.). Second Report on Glossina Investigations in Nyasaland.—*Bull. Entom. Research*, 1915. Dec. Vol. 6. No. 3, pp. 249-265. With 3 plates comprising 6 figs.
- (63) LLOYD (Ll.). On the Association of Warthog and the Nkufu Tick (*Ornithodoros moubata*).—*Ann. Trop. Med. & Parasit.*, 1915. Dec. 30. Vol. 9. No. 4, pp. 559-560.
- (64) MACFIE (J. W. Scott). Observations on the Bionomics of *Stegomyia fasciata*.—*Bull. Entom. Research*, 1915. Dec. Vol. 6. No. 3, pp. 205-229.
- (65) RICARDO (Gertrude). Two new Species of Haematopota from the Federated Malay States.—*Bull. Entom. Research*, 1916. Feb. Vol. 6. No. 4, pp. 403-404.

- (66) RICARDO (Gertrude). Notes on a Collection of Tabanidae from Hong Kong.—*Bull. Entom. Research*, 1916. Feb. Vol. 6. No. 4, pp. 405-407.
- (67) SCHWETZ (J.). Preliminary Note on the General Distribution of *Glossina palpalis*, Rob-Desv., in the District of Lomami, Belgian Congo.—*Ann. Trop. Med. & Parasit.*, 1915. Dec. 30. Vol. 9. No. 4, pp. 513-526. With 1 map.
- (68) SCHWETZ (J.). Quelques observations préliminaires sur les moeurs de la *Glossina brevivalpis*. [Some Preliminary Observations on the Habits of *Glossina brevivalpis*.]—*Bull. Entom. Research*, 1915. Dec. Vol. 6. No. 3, pp. 289-292. With 1 map.
- (69) SCHWETZ (J.). La limite occidentale de la *Glossina morsitans* dans le Katanga du Nord. [The Western Limit of *Glossina morsitans* in Northern Katanga.]—*Bull. Entom. Research*, 1915. Dec. Vol. 6. No. 3, pp. 283-288. With 1 map.
- (70) STANTON (A. T.). Notes on Sumatran Culicidae.—*Indian Jl. Med. Research*, 1915. Oct. Vol. 3. No. 2, pp. 251-258.
- (71) WATERSTON (J.). Chalcidoidea bred from *Glossina morsitans* in Nyasaland.—*Bull. Entom. Research*, 1916. Feb. Vol. 6. No. 4, pp. 381-393. With 9 text-figs.
- (72) WATERSTON (J.). Notes on African Chalcidoidea—III.—*Bull. Entom. Research*, 1915. Dec. Vol. 6. No. 3, pp. 231-247. With 8 text-figs.
- (73) WATERSTON (J.). Notes on African Chalcidoidea—IV.—*Bull. Entom. Research*, 1916. Feb. Vol. 6. No. 4, pp. 413-423. With 6 text-figs.

#### Helminths.

- (74) BEAL (W. P. B.). A Common Trematode Worm found in Horses in West Africa (*Gastrodiscus aegyptiacus*, Sonsino).—*Vet. Record*, 1915. Dec. 11. No. 1431, pp. 260-261. With 1 text-fig.
- (75) BEAL (W. P. B.). Two Trematodes: *Dicrocoelium lanceatum* and *Eurytrema pancreaticum*.—*Vet. Record*, 1916. Jan. 29. No. 1438. With 2 text-figs.
- (76) CAWSTON (F. G.). Schistosomiasis in Natal.—*Jl. Trop. Med. & Hyg.*, 1915. Nov. 15. Vol. 18. No. 22, pp. 257-258. With 4 text-figs.
- (77) CORT (W. W.). Egg Variation in a Trematode Species.—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1, pp. 25-26.
- (78) FOSTER (W. D.). Two New Cases of Polyradiate Cestodes, with a Summary of the Cases already known.—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1, pp. 7-19. With 4 text-figs.
- (79) KRECKER (F. H.). *Filaria cingula* Parasitic in the Skin of *Cryptobranchus allegheniensis*.—*Jl. of Parasitol.*, 1915. Dec. Vol. 2. No. 2, pp. 74-79. With 5 text-figs.
- (80) LECOMTE (A.). Les kystes à Filaires (*Onchocerca volvulus*) au Soudan Français. [Filarial Cysts in the French Soudan].—*Bull. Soc. Path. Exot.*, 1915. Nov. Vol. 8. No. 9, pp. 655-656.
- (81) NAKAGAWA (K.). The Mode of Infection in Pulmonary Distomiasis. Certain Fresh-water Crabs as Intermediate Hosts of *Paragonimus Westermanii*.—*Jl. Infect. Dis.*, 1916. Feb. Vol. 18. No. 2, pp. 131-142. With 2 maps & 4 plates comprising 12 figs.
- (82) STUNKARD (H. W.). Notes on the Trematode Genus *Telorchis* with Descriptions of New Species.—*Jl. of Parasitol.*, 1915. Dec. Vol. 2. No. 2, pp. 57-66. With 1 plate comprising 8 figs & 2 text-figs.

- (83) WEIDMAN (F. D.). Report of an Enzootic of Parasitic Proventricular Worms (*Spiroptera incerta* Smith) of Parrots, with Control of Same.—*Jl. Comp. Path. & Therap.*, 1915. Dec. Vol. 28. No. 4, pp. 313–320. With 4 text-figs.

**Protozoa.**

- (84) FANTHAM (H. B.). Herpetomonads and Vertebrates: A Correction of a Recent Contribution on "Leishmania Problems."—*Jl. Trop. Med. & Hyg.*, 1915. Dec. 15. Vol. 18. No. 24, pp. 277–281.
- (85) MAVOR (J. W.). On the Occurrence of a Trypanoplasm, probably *Trypanoplasma borrelli* Laveran et Mesnil, in the Blood of the Common Sucker, *Catostomus commersonii*.—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1, pp. 1–6. With 1 plate comprising 6 figs.
- (86) SMITH (A. J.) & BARRETT (M. T.). Further Note upon Comparison of *Endamoeba gingivalis* (Gros) and *Endamoeba histolytica* Schaudinn.—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 2, pp. 54–56.
- (87) WATSON (Minnie E.). Some New Gregarine Parasites from Arthropoda.—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1, pp. 27–36. With 2 plates comprising 20 figs.

**Miscellaneous.**

- (88) BEGUET (M.), MUSSO (L.), & SERGENT (Et.). Troisième campagne contre les Acridiens (*Schistocerca peregriana* Ol.) en Algérie au Moyen du *Coccobacillus acridiorum* d'Hérelle. Note Préliminaire. [Third Campaign against *Schistocerca peregriana* Ol. in Algeria with the *Coccobacillus acridiorum* of d'Hérelle.]—*Bull. Soc. Path. Exot.*, 1915. Nov. Vol. 8. No. 9, pp. 634–637.
- (89) CASTELLANI (A.) & JACKSON (T. W.). Notes on Certain Insecticides.—*Jl. Trop. Med. & Hyg.*, 1915. Nov. 15. Vol. 18. No. 22, pp. 253–255.
- (90) CHALMERS (A. J.) & HADDAD (G.). *Streptococcus equinus* Septicaemia in the Anglo-Egyptian Sudan.—*Jl. Trop. Med. & Hyg.*, 1915. Dec. 1. Vol. 18. No. 23, pp. 265–269.
- (91) FOX (H.). Pancreatitis in Wild Animals.—*Jl. Comp. Path. & Therap.*, 1915. Dec. Vol. 28. No. 4, pp. 298–312.
- (92) GUPTA (M. C.). Anthrax in Elephants.—*Vet. Jl.*, 1915. Nov. Vol. 71. No. 485, pp. 522–530. With 2 text-figs.
- (93) HALL (I. C.) & STONE (R. V.). The Diphtheroid Bacillus of Preisz-Nocard from Equine, Bovine, and Ovine Abscesses, Ulcerative Lymphangitis and Caseous Lymphadenitis.—*Jl. Infect. Dis.*, 1916. Feb. Vol. 18. No. 2, pp. 195–208.
- (94) d'HÉRELLE (F.). La campagne contre les sauterelles en Tunisie en 1915. [The Campaign against Locusts in Tunis during 1915.]—*Bull. Soc. Path. Exot.*, 1915. Nov. Vol. 8. No. 9, pp. 629–633.
- (95) VELU (H.) & BOUIN (A.). Essais de destruction de *Schistocerca peregriana*, Olivier, au Maroc, par l'emploi des cultures microbiennes (*Coccobacillus acridiorum* d'Hérelle.) [Attempts to destroy *Schistocerca peregriana* Olivier with Cultures of the *Coccobacillus acridiorum* of d'Hérelle.]—*Bull. Soc. Path. Exot.*, 1915. Nov. Vol. 8. No. 9, pp. 638–641.

- (158) SEURAT (L.-G.). Sur l'habitat normal et les affinités du *Protospirura numidica* Seur. [The Normal Habitat and the Affinities of *Protospirura numidica* Seur.]-*C. R. Soc. Biol.*, 1916. Feb. 5. Vol. 79. No. 3. pp. 143-146. With 4 text-figs.
- (159) SEURAT (L.-G.). Sur l'habitat normal et les affinités du *Rictularia proni* Seur. [The Normal Habitat and the Affinities of *Rictularia proni*.]-*C. R. Soc. Biol.*, 1916. Feb. 5. Vol. 79. No. 3. pp. 146-149. With 2 text-figs.

**Protozoa.**

- (160) CHATTON (E.) & BLANC (G.). Précisions sur la Morphologie de l'hématozoaire endoglobulaire de la Tarente : *Pirhemocytion tarentolae* Chatton et Blanc. [Details of the Morphology of the Intracorpuseular Parasite *Pirhemocytion Tarentolae*.]-*C. R. Soc. Biol.*, 1916. Jan. 22. Vol. 79. No. 2. pp. 39-43. With 1 text-fig.
- (161) SANGIORGI (G.). Di un Coccidio parassita del Rene della Cavia. [A Coccidium Parasitic in the Kidney of the Guinea-pig.]-*Pathologica*, 1916. Feb. 15. Vol. 8. No. 175. pp. 49-53.

**Miscellaneous.**

- (162) CONOR (M.). Les invasions de Sauterelles en Afrique Mineure (Figurations et Textes anciens). [The Invasions of Locusts in Africa (Ancient References).]-*Arch. Inst. Pasteur Tunis*, 1916. Apr. Vol. 9. No. 3. pp. 149-156. With 1 plate and 1 text-fig.
- (163) COSCO (G.) & ANGELO (A.). La Virulenza del Sangue degli Animali malati di Afta epizootica. [The Virulence of the Blood of Animals affected with Foot and Mouth Disease.]-*Clinica Vet.*, 1916. Apr. 15. Vol. 39. No. 7. pp. 193-195.
- (164) HALL (J. C.) & STONE (R. V.). The Diphtheroid Bacillus of Preisz-Nocard from Equine, Bovine, and Ovine Abscesses. Ulcerative Lymphangitis and Caseous Lymphadenitis.—*Jl. Infect. Dis.*, 1916. Feb. Vol. 18. No. 2. pp. 195-208.
- (165) d'HERELLE (F.). Campagne contre les *Schistocerca peregrina* en Tunisie par la méthode biologique. [Campaign against Locusts in Tunis on Biological Lines.]-*Arch. Inst. Pasteur Tunis*, 1916. Apr. Vol. 9. No. 3. pp. 135-148.
- (166) KOLMER (J. A.) & SMITH (A. J.). The Bactericidal and Protozoocidal Activity of Emetin Hydrochloride in Vitro.—*Jl. Infect. Dis.*, 1916. March. Vol. 18. No. 3. pp. 247-265.
- (167) KOLMER (J. A.) & SMITH (A. J.). The Bactericidal and Protozoocidal Activity of Emetin Hydrochloride in Vivo.—*Jl. Infect. Dis.*, 1916. Mar. Vol. 18. No. 3. pp. 266-276.
- (168) RETTERER (E.) & NEUVILLE (H.). De la rate du Rhinocéros et du Tapir. [The Spleen of the Rhinoceros and of the Tapir.]-*C. R. Soc. Biol.*, 1916. Apr. 1. Vol. 79. No. 7. pp. 267-270.
- (169) RIES (J.-N.). Sur la pathogénie et le traitement de l'anémie pernicieuse et infectieuse du cheval. [The Pathology and Treatment of Equine Pernicious and Infectious Anaemia.]-*Receuil de Méd. Vét.*, 1916. Jan. 15-Feb. 15. Vol. 92. Nos. 1 & 2. pp. 14-20.
- (170) TERNI (C.). Ricerche ed esperienze per lo Studio della immunità all' Afta. [Immunity against Foot and Mouth Disease.]-*Clinica Vet.*, 1916. May 15. Vol. 39. No. 9. pp. 257-261.



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[June 30, 1916.]

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TROPICAL VETERINARY  
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VOL. 4.]

1916.

[No. 3.

## PROTOZOOLOGY.

## (a) AMOEBIASIS.

- (171) DARLING (S. T.). **Entamebic Dysentery in the Dog.**—*Proc. Med. Assoc. Isthmian Canal Zone for the Half-Year, Apr. to Sept. 1913* [1915.] Vol. 6. Part 1. pp. 60–62.

This appears to be the first case recorded of naturally acquired entamebic dysentery in the dog.

The subject was a large deerhound which had been in the Panama Canal Zone for several months and had just been brought into the laboratory for observation in connection with hookworms. On admission it was suffering from blood-stained diarrhoea and great abdominal pain. Faeces on examination were found sometimes to contain trophozoites. The animal became very emaciated and died after 11 days.

Post-mortem examination showed that the mucous membrane of the colon was dotted all over with innumerable minute red punctate superficial erosions, but no large ulcers. Smears always contained entamoebae in which at times red blood cells were seen. The ileum contained hundreds of hook-worms, but smears of the mucous membrane contained no entamoebae although a few were seen in sections on the surface.

On histological examination the minute red ulcers on the mucous membrane of the colon were seen to be infiltrated with leucocytes and entamoebae. The superficial portion of the ulcers was denuded of epithelium, and the surrounding surface was covered with mucus which contained many trophozoites apparently vegetating in it. Clumps of entamoebae could be seen in places making their way into the intestinal crypts. The invasion was very superficial and the submucosa and muscularis were not involved. The lesions were thus not like those seen in the cat experimentally infected per rectum with the trophozoites of *E. tetragena* of man. This suggests that the lesions were caused by a different species of entamoeba.

*Description of the trophozoite.*—In the wet state it measured from 16 to 32 microns in diameter; the majority contained no red blood corpuscles but some contained up to 8 or 10. The ectosarc was clear and well differentiated from the endoplasm which was granular and

contained vacuoles. The nucleus and usually its karyosome were easily detected. When stained *intra vitam* with gentian violet the peripheral chromatin of the nucleus was displayed as many fine particles, and the centriole and karyosome were distinctly shown. With phosphotungstic acid haematoxylin, and iron haematoxylin, the trophozoites stained well and the nucleus was seen to be made up of rather fine chromatin granules. The centriole was not uncommonly eccentrically placed while the karyosome appeared as a finely granular ring.

Specimens dry fixed and stained with Giemsa and differentiated with ammoniated ethyl alcohol present a picture not unlike *E. tetragena*, except that the karyosome is quite different from that usually seen in the latter. It is smaller and more dense, its band is broader and it is never seen in the form of a reticulum, nor as granules scattered through the nucleus as in *E. tetragena*. Specimens in films wet fixed and stained with haematoxylin gave the following average diametrical measurements in microns. Trophozoite 21 to 28, nucleus 5.5, karyosome 2.4, centriole 0.7.

All the trophozoites were of the large vegetative type usually seen in active lesions. Their appearance was in general like that of *E. tetragena* except for important differences in structure of the nucleus. Cysts and other perpetuating forms were not discoverable. A puppy fed with material containing trophozoites six hours after the death of the host did not contract the disease. Rectal inoculations were not made.

From the characters enumerated above the author believes that the entamoeba found in the dog differs from *E. tetragena* and *E. coli* which cause lesions in the cat and man, and provisionally proposes the name *E. venaticum* for this new species.

(172) WARE (F.). The Possibility of Amoebic Dysentery in the Dog, and its Treatment with Emetin.—*Jl. Comp. Path. & Therap.* 1916. June. Vol. 29. Pt. 2. pp. 126-130.

Fresh faeces were examined microscopically from a rather acute case of dysentery in a bitch. This animal belonged to a pack of foxhounds kept at a hill station in India, in which dysentery was stated to have been a considerable source of trouble for some years past. In these smears of faeces one or more amoebae, which were pronounced to be extremely like *Entamoeba histolytica*, the cause of amoebic dysentery in man, were present in at least every other field of the microscope. Six other animals were also clinically affected but not to so serious an extent as in the above case. No microscopic examination was made of their faeces.

All the above cases were treated with injections of emetin hydrochloride in daily doses of  $\frac{1}{2}$  or 1 grain until the symptoms abated. All quickly recovered except one case, where the animal had been ill for ten months. Post-mortem examination of the latter animal indicated that the large intestine was affected with numerous small ulcers, the stomach was considerably inflamed, and the liver enlarged. No search for amoebae seems to have been made.

- (173) THOMSON (J. Gordon) & THOMSON (D.). **Some Observations on the Effect of Emetine Administration on the Free Vegetative Forms and Cysts of *Entamoeba histolytica* and *Entamoeba coli*.**—*Jl. Roy. Army Med. Corps.* 1916. June. Vol. 26. No. 6. pp. 683–694. With 1 plate.

#### Summary of Conclusions.

“(1) If an amoebic case receive a continuous course of treatment with emetine of not less than a total of seven to ten grains of the drug administered in grain doses daily for a week, it is probable that he will never become a carrier of cysts. In order, however, to make certain of this, it is better to carry the treatment further. Such treatment also prevents relapses.

“(2) Cysts of *E. histolytica* can be cleared out of a patient after six grains of emetine, but, to make absolutely certain of this, it is better to exceed this dose. This treatment must be combined with saline purgatives, so as to get free daily action of the bowels.

“(3) A case of amoebic dysentery inefficiently treated with less than seven grains of emetine is likely to become highly dangerous as a carrier of cysts. One or two small doses may act beneficially and get rid of active symptoms, such as the passage of blood and mucus, but it may at the same time stimulate the formation of large numbers of cysts. The cessation of treatment on the disappearance of active symptoms is fraught with danger, both to the patient, and subsequently, to others.

“(4) All patients known to have blood and mucus in their stools and to have received less than an efficient total quantity of emetine ought to be examined for the presence of cysts in the faeces, as it is highly probable they have thereby become dangerous carriers.

“(5) The transmission of amoebic dysentery is undoubtedly due to the ingestion of cysts. This is brought about by the contamination of food, fingers, or flies. Cysts may also be carried along with sand particles by wind.

“(6) The powers of resistance of cysts outside the body are considerable, and this should be borne in mind by all responsible for sanitary prophylactic measures against dysentery.”

#### (b) ANAPLASMOSIS.

- (174) WALKER (J.). **Some Observations in connection with the Immunisation of Cattle against South African Redwater and Genuine Gallsickness (Anaplasmosis).**—*Union of South Africa. Dept. of Agric. 3rd and 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 501–526. With 1 chart. Pretoria: Govt. Printing & Stationery Office.

The author begins this article by giving a complete review of the literature dealing with anaplasmosis.

#### (1) OBSERVATIONS IN CONNECTION WITH THE TRANSMISSION OF REDWATER.

A series of 24 inoculations and immunity tests with redwater-gallsickness blood was performed on cattle, the results of which are summarised as follows:—

“1. The inoculation of susceptible cattle with redwater-gallsickness blood did not always result in a reaction to redwater. (No rise of temperature occurred and no *P. bigeminum* were noted in the smears. Animal remained apparently healthy).

“2. The blood of an animal which gave no reaction to redwater when inoculated with redwater-gallsickness blood does not transmit redwater to susceptible cattle.

" 3. Susceptible animals which failed to react to redwater after inoculation are susceptible to redwater.

" 4. The inoculation of a susceptible animal with blood which was collected from a beast when reacting to redwater, and in which *P. bigeminum* parasites were frequent does not always produce a redwater reaction (one experiment), and the animal remains susceptible to redwater.

" 5. An animal which has reacted to a strain of redwater may again react when inoculated with blood of a different strain.

" 6. The redwater reaction may manifest itself in a rise of temperature without the appearance of *P. bigeminum* in the smears during or shortly after the temperature reaction."

## (2) OBSERVATIONS IN CONNECTION WITH THE TRANSMISSION OF ANAPLASMOSIS.

(A) *The Invariability of Transmission of Anaplasmosis by means of inoculation of redwater-gallsickness blood.* From the above experiments the author also draws the following conclusions :—

" (1) That the inoculation of susceptible cattle with redwater-gallsickness blood did not always produce a reaction to redwater ; a reaction to anaplasmosis however invariably occurred.

" (2) The blood of animals which failed to react to redwater after inoculation with redwater-gallsickness blood produced in susceptible cattle anaplasmosis but not redwater.

" (3) Blood collected from an animal which had been inoculated with redwater-gallsickness blood during the redwater reaction and thus before the anaplasma infection appeared did not produce anaplasmosis in a susceptible animal.

" (4) The shortest period in which *Anaplasma marginale* appeared after inoculation was 20 days, longest period 44 days, average period 31 days. For *A. centrale* the shortest period was 16 days, longest 47, average 32 days."

### (B) *The Mutability of Anaplasma centrale.*

THEILER has classified the anaplasmata into two varieties, viz., the *Anap. marginale* and *Anap. marginale* (variety *centrale*) ; the former is responsible for deaths occurring from genuine gallsickness contracted naturally while the latter is much less virulent and, when inoculated into a susceptible animal, transmits the Centrale infection and protects against the former (the *Anap. marginale* proper). [Hence THEILER'S method of immunisation against gallsickness.] It was found that inoculation of the blood of an animal immune to the Centrale variety did not always result in a pure Centrale infection being transmitted, but produced in some cases a pure Marginale infection. A series of experiments was performed, which are recorded on the charts, in order to see whether mutation from Centrale to Marginale occurs in " passage " through animals. The author's conclusions are given in the following résumé :—

" The observations extended over a period of five years and a few days, namely, from 28th February, 1910, to the 8th March, 1915 ; during this time forty-three cattle were inoculated, and in thirty-five of these the experiment was controlled by the writer.

" *In the first series of inoculations* no mutation occurred during the passage through eight successive generations, viz. from the 28th February, 1910, to 30th December, 1913.

" An animal inoculated approximately eight months later than the latter date with blood of the seventh generation and two animals inoculated with blood of the eighth generation reacted to *Anaplasma marginale*.

" *In the second series of inoculations*, whereas no mutation occurred in some cases in passage through successive generations, viz. from the 28th February, 1910, to the 8th March, 1915, two cattle inoculated with blood of an eighth generation animal reacted to *Anaplasma marginale*.

"In the third series of inoculations, whereas centrale blood of the sixth generation produced a centrale infection, blood obtained from the same animal, approximately five and nine months later, produced a marginale infection and the inoculation of the blood of two imported animals which reacted to *Anap. centrale* resulted in a marginale infection.

"Conclusion.

"A mutation from *Anap. centrale* to *Anap. marginale* may occur in passage through a susceptible animal.

"The determination of the type is probably according to the Mendelian law, the marginale being the dominant—the centrale the recessive type."

(175) VEGLIA (F.). *The Cultivation of Anaplasma marginale in Vitro.*—*Union of South Africa. Dept. of Agric. 3rd & 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 527-532. Pretoria: Govt. Printing & Stationery Office.

"The culture media utilised were:—

"(1) Pure defibrinated blood, viz., blood from an animal infected with anaplasmosis.

"(2) Salt solution (sodium chloride) as used by Nuttall for the cultivation of *Babesia canis*.

"(3) Sodium citrate solution, as used by Carpano for the cultivation of *Nuttalla equi*.

"(4) Ordinary bouillon, as used by Miyajima for the cultivation of *Babesia bovis*" . . . .

"Conclusions:—

"(1) Anaplasms grow and multiply in the different artificial media indicated above.

"(2) Defibrinated blood and Carpano media are most suitable for the cultivation of anaplasms.

"(3) Basophile granulations and Jolly's bodies, which are noted in anaemic blood, behaved differently to anaplasms on cultivation, inasmuch as they did not increase in number and finally disappeared.

"(4) Normal blood of cattle and other animals not infected with anaplasms did not develop any intracellular bodies resembling anaplasms when cultivated in the way indicated.

"(5) In cultures made with pure anaplasms or anaplasms and babesia mixed, no forms could be traced which would suggest a transition of one to another.

"(6) The defibrinated blood of a susceptible normal animal mixed with a culture appeared to be favourable for the development of the anaplasms, whilst the blood of an animal recovered from the recent attack of anaplasmosis appeared to inhibit the growth of the anaplasm.

"(7) The cultivation of anaplasms by a sub-culture has so far succeeded in the one instance attempted.

"(8) It appears that it is possible to grow anaplasms taken from an infected animal during the incubation stage of the disease.

"(9) The increase of anaplasms in the cultures corresponds to the increase of the anaplasms in the living animal.

"The oscillating decrease in the number of anaplasms noted in an animal that is recovering has its simile in the cultures."

#### (c) LEISHMANIASIS.

(176) FINZI (Guido). *Leishmaniose et tuberculose chez le chien.* [Leishmaniasis and Tuberculosis in the Dog.]—*Bull. Soc. Path. Exot.* 1916. July. Vol. 9. No. 7. pp. 429-432.

Finzi records the case of a dog which had been brought for treatment to the clinic of the Veterinary School at Turin, and which later died of generalised tuberculosis. On examining preparations from the blood and spleen *Leishmania infantum* was easily discoverable. This dog had been brought from Cyrenaica a month prior to its death.

## (d) AVIAN MALARIA.

- (177) GONDER (R.). On the Transmission of *Haemoproteus columbae*.—*Union of South Africa. Dept. of Agric. 3rd & 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 625-632. Pretoria : Govt. Printing & Stationery Office.

Gonder expressed his views upon the natural transmission of *H. columbae* at the International Medical Congress in London in 1913, and the investigations upon which these views were based are published in this article. The following is the author's summary :—

"The infectivity of the parasite *Haemoproteus columbae* is not hereditary in the fly-carrier. The parasite develops in the fly, *Lynchia capensis* (*olfersia*), only to the ookinete, which, through a double protoplasmic segmentation, loses all its pigment and a part of its protoplasm. So long as the ookinetes are present in the stomach of the fly transmission of the parasite by the fly is possible.

"The flies 'clean' themselves from an infection whenever they engorge on the blood of a healthy pigeon, but do not become immune against reinfection.

"A cleansing of the flies cannot take place so long as they feed upon infected pigeons.

"Artificial transmission from infected pigeons to healthy pigeons cannot be brought about by ordinary blood inoculation, but is easily effected by the injection of ookinetes cultivated in the moist chamber.

"Direct transmission is also possible if lung material be used."

## (e) SARCOSPORIDIOSIS.

- (178) GALLI-VALERIO (B.) Are Sarcosporidia Aberrant Forms of Cnidosporidia of Invertebrates?—*Jl. Parasit.* 1916. Mar. Vol. 2. No. 3. pp. 126-128.

DARLING (1915) suggests that, on account of the facility with which herbivora can ingest the bodies or the excreta of insects, etc., infected with neosporidia, it is possible that sarcosporidia may be "side-tracked varieties" of some of these parasites of invertebrates which are unable to continue further their life cycle in the muscles of an indefinite host.

SCOTT (1915) also infers from his experiments that the sheep is not the definite host of *S. tenella*.

The author states that it is probable that sarcosporidia are identical with cnidosporidia, and believes that if it is possible to demonstrate that spores of sarcosporidia produce amoebae the identity of the two orders is still more probable.

PIANA (1896) obtained from cultures of *S. tenella* on certain media, bodies which presented motile amoeboid movements and later became encysted. The author himself (1913) confirmed these experiments with *S. muris*. It was not possible to produce Balbiani cysts in the oesophagus of a sheep infected with Piana's cultures.

ERDMANN (1914) observed amoeboid bodies in the intestinal cells of a mouse infected *per os* with sarcosporidia.

Reference is also made to the similarity between the amoebae of certain myxosporidia and those of *S. muris*.

THÉLOHAN and AUERBACH proved that the spores of cnidosporidia produced amoeboid bodies in the duodenum of fishes.

The author believes that the amoebae obtained from cultures of sarcosporidia may be destroyed in the stomach and suggests that in future experiments they might be introduced direct into the intestines of sheep.



The author's summary is as follows :—

“(1) The observations of Piana and Galli-Valerio to the effect that spores of Sarcosporidia produce amoebic bodies in cultures, more closely relate the Sarcosporidia to the Cnidosporidia.

“(2) If true that Sarcosporidia are only aberrant forms of Neosporidia of invertebrates, then the hypothesis of Darling becomes more probable.”

- (179) FRANCO (E. E.) & BORGES (I.). **Sur la sarcosporidiose bovine.** [Bovine Sarcosporidiosis.]—*Arq. do Inst. Bact. Camara Pestana.* 1916. Vol. 4. No. 3. pp. 269–289. With 10 coloured plates comprising 19 figs., & 1 plate comprising 4 figs.

In the course of the years 1885 to 1914, 67 carcasses of cattle were rejected at the Lisbon Municipal Abattoir on account of sarcosporidiosis, representing 0·0563 per cent. of animals slaughtered. The animals affected were in the great majority of cases brought in from the Alentejo province.

The lesions affected the connective tissue, subcutaneous and intermuscular, and took the form of small cysts from 250 to 400 microns in diameter which resembled fine grains of sand in appearance. They were sometimes gathered together in groups, and sometimes disseminated at distances less than 5 millimetres apart. Lesions of “anasarca and elephantiasis,” such as described by BESNOIT and ROBIN, were not seen by the authors.

The article is almost entirely devoted to an analysis of the histology of the lesions ; the life history of the parasite is not studied.

*Cysts.*—These are composed of three parts, which are derived from the parasite itself, viz. :—(A) an external “anhist” membrane, (B) a cellular internal membrane consisting of a finely reticulated protoplasmic layer, and (C) the spore contents consisting of an enormous number of very small, closely packed, crescentic bodies.

Around the cysts is seen a zone of reaction of variable thickness consisting of (a) connective tissue cells, (b) eosinophile leucocytes, and (c) plasma cells.

In one of the cases histologically examined an account of cysts invading the dermis and the muscles is given.

A large number of the cysts were found to have become ruptured and, instead of spores, contain various connective tissue cellular elements.

The histology of the lesions is well depicted in the coloured plates.

The authors believe that the sarcosporidiosis observed by them is the same as that studied and described by BESNOIT and ROBIN, due to the genus *Sarcocystis besnoiti* (MAROTEL, 1912).

#### (f) SPIRILLOSIS.

- (180) BLIER (Jules). **L'hémoglobininurie bovine du Chili (Maladie à parasites spirochétiformes).** [Bovine Haemoglobinuria in Chili (a Disease Due to Spirochaetoid Parasites).]—*C. R. Acad. Sci.* 1914. Dec. 14. p. 815. [Extracted in *Rev. Gén. de Méd. Vét.* 1916. June 15. Vol. 25. No. 294. pp. 262–264.]

There exists in Chili, in the district of Santiago, a redwater of cattle commonly known as *Meada de Sangre*. It is a rather rare seasonal affection most frequent in autumn (i.e., February and March).

The characteristic symptoms are a discharge of blood-tinged urine accompanied by fever, exophthalmia, mania, vertigo, general icterus, and a discharge of blood from the anus, and the gums often bleed.

The disease generally runs its course in about 48 hours and always ends by the death of the animal. In farms where imported cattle are numerous, up to 5 per cent. of the bovines may succumb annually to the disease. However, throughout Chili it is a good deal less common than anthrax, with which it is often mistaken, and this confusion is aggravated by the presence of blackquarter. It had previously been noticed that the anthrax bacillus was absent from the spleen in these cases.

If the animal is slaughtered at the onset of symptoms the lesions show a considerable resemblance to those of yellow fever, viz., yellowish discolouration of the flesh and serous membranes, blood in the stomachs, hypertrophy of the gall bladder, haemoglobinuria, and liver affected with fatty degeneration and spotted with small haemorrhagic centres about the size of peas in which the parasite which is the cause of the disease can be found. Also, one notices hypertrophy of the spleen, profound changes in the suprarenal capsules, subcutaneous haemorrhages, often on the diaphragm a veritable roseola, and sometimes a blood-stained subcutaneous oedema. These lesions disappear if the disease is allowed to terminate with the death of the animal.

The clue to the cause of the disease is given by early slaughter. The specific germ was not perceived for a long time for, as in Sakharoff's spirillosis of geese, bacteriolysis takes place before death. In spite of the redwater the disease is not a piroplasmosis, and various observers have confirmed this point (LUCET, LIGNIERES, SIVORI, MAMERTO CADIZ, MABILAIS, BLIER). Ixodes have never been found on affected farms.

The redwater is caused by an organism which the author considers he discovered in 1912, and which he has always been able to discover since then on slaughter at the onset of symptoms. The organism apparently is not easy to classify. It recalls at first sight a spirillum or spirochaete, but it differs from them in that it possesses a plasticity which enables it to execute contractile movements. It is longer as a rule than the majority of known spirochaetes, and it may exceed 60 microns in length and its breadth then is about 1 micron. The shorter forms are swollen towards the centre. It is sometimes provided with a few undulations of regular length but these are never found in the same part of the body. One extremity of the organism is much thinner than the other. It stains uniformly with Giemsa. When stained with Borrel's blue and eosin it sometimes shows bright red, refractile granules. Ordinarily the organism has the form of a spirochaete, but it recalls the parasite described by the brothers SERGENT (genus *Sergentella* of BRUMPT, 1910) and other observers.

The author considers that it is the causal organism of the disease because when taken from the small haemorrhagic lesions in the liver of a subject slaughtered at the commencement of symptoms, desensitised by washing for 15 minutes in lukewarm sterile broth, and inoculated into the abdominal cavity of cattle it reproduces the disease, but with mild symptoms (slight fever, hepatic roseola, biliary haemoglobinuria, and the presence of the parasite in the lesions).

The period of incubation is from five to six days and during this period one can recover the microorganism from the blood by means of centrifugalisation. As in the case of yellow fever the disease can only be transmitted at the onset of symptoms. The desensitisation of the virus appears indispensable and all other methods of inoculation have failed in the author's hands.

The specific organism was not found in numerous post-mortem examinations of animals not affected with the disease, and in the affected animals it can only be found in the lesions, where it sometimes requires considerable search. It has never yet been seen alive.

As in the case of yellow fever recoveries occur; relapses may take place, but never in the same season, and they are exceptional. It is probable that they are due to re-infection. As they take place at intervals of several years a certain degree of immunity is probable. Young animals are never infected. A single case of transmission to the foetus has been observed by the author.

The sporadic nature of the redwater strongly points to infection by indirect contagion. The transmitting agent is unknown but many breeders incriminate an acarid of the genus *Tetranychus* which lives in the grass and weaves webs and is ingested by cattle whilst grazing. This opinion is very much disputed, but the disease is sometimes known under the name of *tela araña* (spiders web). Some farmers get rid of this web by harrowing the pastures. The heavy autumnal rains cause the enzootic very nearly to disappear.

It seems that one or more substances of unknown nature considerably delay putrefaction in animals dead of the disease.

(181) VELU. **Sur la spirillose equine au Maroc.** [Equine Spirillosis in Morocco.]—*Rec. Méd. Vét.* 1916. Apr. 15. Vol. 92. No. 7. pp. 215-224. With 2 text-figs.

Equine spirillosis has been described by THEILER in the Transvaal, by G. MARTIN in French Guinea, S. DODD in the Transvaal, STORDY in British East Africa, and CARPANO (Matteo) in Erythrea.

The specificity of *Spirillum equi* has not yet been established. Experimental inoculations seem to have been difficult to realise. The spirillary infection is without doubt often associated with other affections such as trypanosomiasis or horse sickness. Also the differences between the pathogenicity of the various equine spirilla encountered are very considerable.

Velu has studied the disease in three horses naturally infected, which were kept under his observation. Clinically the disease presented the same aspect as that of trypanosomiasis affecting horses in Morocco, viz., a mild fever accompanied with oedema of the sheath, etc., from which the animals apparently recovered after a couple of months. Examination of the blood during the course of the symptoms only on very few occasions showed some rare spirilla.

Velu succeeded in transmitting the disease by inoculation to white rats, dogs, a rabbit and two fowls, and he thus summarises his results: "Spirillosis of the horse is transmissible to the dog, rabbit, and rat. Animals which receive subcutaneously or intravenously from 3 to 20 cc. of horse blood which does not disclose any visible spirilla under the

microscope, become affected with a disease which terminates fatally and is characterised by low fever, progressive emaciation, and numerous parasites in the peripheral blood. The spirilla disappear pretty quickly from the general circulation. It is possible to transmit this spirillosis by 'passage' from the dog to the rabbit and the rat."

The spirilla measured from 12 to 21.6 microns in length when not uncoiled, by from 0.25 to 0.3 microns at most in width, and contain from four to six spiral turns. Forms about to undergo transverse division may attain a maximum length of 33.6 microns and present up to 10, or even 12, spiral turns. The spirillum stains uniformly throughout its body.

(182) ROBERT (A. Eug.) & SAUTON (B.). **Action du bismuth sur la spirillose des poules.** [The Action of Bismuth on the Spirillosis of Fowls.]—*Ann. Inst. Pasteur.* 1916. June. Vol. 30. No. 6. pp. 261-271.

The authors utilised for their experiments sodium bismuthotartarate, as aqueous solutions of this compound can be sterilised in the autoclave and they are stable in the presence of the majority of salts, serum, etc., but are, however, precipitated by calcium salts. In all their experiments they used solutions containing exactly one per cent. of bismuth itself, not of the bismuthotartarate.

*Toxicity.* A dose of from 30 to 35 mg. of Bismuth per kilog. body weight injected intravenously can be tolerated by a healthy fowl; animals infected with spirilla can only stand a dose of 15 to 20 mg.; 100 mg. of bismuth per kilog. injected intramuscularly can be tolerated without any inconvenience by healthy fowls.

*Action in vitro.* When equal parts of blood from a fowl severely infected with spirilla and a neutral solution of sodium bismuthatartarate containing 1 per cent. of bismuth are mixed, *Spirillum gallinarum* retains its motility for more than three days.

*Action in vivo.* The authors used as virus undiluted blood rich in spirilla.

*Preventive Treatment.* The intravenous injection of 20 to 30 mg. of bismuth per kilog. 24 hours before inoculation with 0.5 cc. of infective blood delays the appearance of spirilla by a day and then the disease develops normally, probably due to a too rapid elimination of the salt or to its having become partially insoluble in the body. On the other hand in the same conditions of time an intramuscular injection of 50 to 70 mg. of bismuth per kilog. acts efficaciously.

The injection of bismuth a few hours after infection always retards the development of the organisms. At no period can spirilla be found in the blood of a fowl injected intravenously six hours after infection with a dose which, however, is not well tolerated—of 20 mg. of bismuth per kilog. In the same conditions an injection of 15 mg. does not always prevent the disease to the same degree. The disease when it manifests itself is, however, benign and always disappears after a second injection. Treatment with 10 mg. brings about only a slight delay in the appearance of spirilla and the disease then develops as in control animals.

Better results were obtained by giving two successive injections of bismuthotartrate, 6 hours and 30 hours respectively, after inoculation with spirilla. The organisms never appeared in the blood of animals treated with two doses of 15 mg. each. Positive results were also obtained in four cases out of every five by two injections of 10 mg. each, or by successive injections of 10 and 5 mg., respectively. It is noteworthy that these two last doses are more efficacious than a single equivalent dose of 15 mg. because the circulation of bismuth in the body is renewed.

An intramuscular injection of 60 to 70 mg. of bismuth per kilogram, four hours after infection delays and considerably alleviates the disease. Spirilla only appear in the blood of animals thus treated in very small numbers and during a very short period of time.

*Curative Treatment.* When, after the first appearance of the spirilla, one treats an infected animal by giving an intravenous injection of 12 to 15 mg. of bismuth per kilogram, the spirillosis takes on a milder course, and fowls thus treated generally show organisms no longer in their blood when the infection is at its maximum in the case of control animals. If intervention takes place later, 48 to 72 hours after infection, a distinctly curative action of the bismuth is observed and the disease never takes on an acute form, which in the authors' experiments caused the death of 33 per cent. of animals which were not treated.

However, the best results are obtained by treating infected animals with two successive intravenous injections of 10 mg. per kilogram, 30 and 48 hours, respectively, after inoculation with spirilla. The organisms then never, or hardly ever, develop in the blood after the first injection; they have always disappeared 24 hours after the second. The treated animals remain in good condition and do not as in the case of control animals lose a considerable amount of weight.

CONCLUSIONS. "From these experiments it results that sodium bismuthotartrate, contrary to what one observes *in vitro*, exerts a bactericidal action on *Spirochaeta gallinarum* in the animal body. Its influence, which was very distinct since we were able to prevent and cure the infection in a relatively large number of cases, was not, however, always manifested in our experiments with all the regularity desirable. This depends probably on the nature of the bismuthic combination utilised, which, from our observations, may lose its activity as a result of fixation or insolubilisation. It is presumable, and our experiments, abruptly interrupted at the end of July 1914 by the war, already confirmed this hypothesis, that the best results would be obtained by the use of bismuthic compounds susceptible of circulating better in a soluble form in the body. We hope to continue some day our incomplete researches in that direction, but we can already say that we have observed the constant efficacy of bismuth, whatever may be the nature of the chemical combination it forms part of."

#### (g) TOXOPLASMOSIS.

(183) CARINI (A.) & MIGLIANO (L.). Sur un Toxoplasme du cobaye (*Toxoplasma Caviae*, n. sp.). [A Toxoplasma of the Guinea-pig]. —*Bull. Soc. Path. Exot.* 1916. July. Vol. 9. No. 7. pp. 435-436.

In a young guinea-pig found dead without having shown previous symptoms the authors discovered the presence of toxoplasms.

On post-mortem examination the spleen was three or four times the normal size, friable, and soft in consistence; the liver was increased

in size and congested, the lungs showed some congested centres, and the intestines also were reddened.

Microscopic examination of the affected organs showed, after staining with Leishman or Giemsa, bodies which presented all the characters of toxoplasms. They were 5 to 8 microns long by 2 to 4 microns broad, generally a little curved, oval or pear-shaped, rarely rounded or irregular. The protoplasm stained a pale blue colour and the nucleus a reddish-violet. The parasites were generally free, but sometimes endocellular. In preparations from the liver, organisms undergoing multiplication were found in the form of masses of protoplasm in which were scattered numerous nuclei.

Two pigeons were inoculated subcutaneously with an emulsion of the affected organs. They both died in 17 days. For the first 14 days no visible symptoms were observed; during the last three days there were manifested an intense thirst, inappetence, and during the last day the pigeons became very dejected and their feathers stood erect.

On post-mortem examination the following lesions were noted, viz., on the surface of the lungs numerous small greyish spots which corresponded with centres of necrosis, and the liver was very much enlarged and congested. The parasites were very numerous in the liver, and still more numerous in the lungs.

The authors state that they had previously observed the presence of toxoplasms in guinea-pigs, but these had been inoculated with various pathological products, and so they were not certain that they were dealing with spontaneous infections. Several observers have already noted that guinea-pigs can be experimentally infected with toxoplasms.

The authors believe that the case recorded by them enables them to state definitely that one may encounter spontaneous infections with toxoplasms in the guinea-pig. It is probable that the toxoplasm seen in the guinea-pig is the same as that of the rabbit and the dog, but this has not yet been proved, and the name *Toxoplasma caviae* is thus suggested.

The following list of toxoplasms recorded up to the present is given :-

<i>Toxoplasma cuniculi</i>	..	SPLENDORE, 1908.
„ <i>gondii</i>	..	NICOLLE and MANCEAUX, 1908.
„ <i>canis</i> ..	..	MELLO, 1910.
„ <i>talpae</i>	..	MINE, 1910.
„ <i>columbae</i>	..	CARINI, 1911.
„ <i>musculi</i>	..	SANGIORGI, 1913.
„ <i>avium</i>	..	ADIE 1909; MARULLAZ, 1913.
„ <i>pyrogenes</i>	..	CASTELLANI, 1914.
„ <i>ratti</i> ..	..	SANGIORGI, 1914.
„ <i>caviae</i>	..	CARINI and MIGLIANO, 1916.

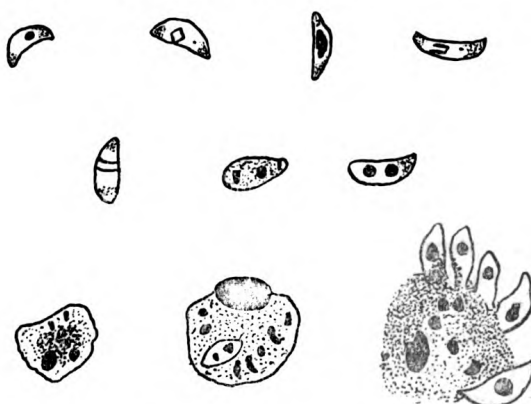
(184) van SACEGHEM (R.). **Observations sur des infections naturelles par *Toxoplasma cuniculi*.** [Observations on Natural Infections by *Toxoplasma cuniculi*.]—*Bull. Soc. Path. Exot.* 1916. July. Vol. 9. No. 7. pp. 432-434. With 10 text-figs.

Natural cases of the above disease were found by the author in rabbits born in the Lower Congo; the disease was only observed in the case of young subjects from 2½ to 3 months old.

The rabbits which became affected were kept in a large box supported by four poles about 27 cm. high. Rabbits in cages placed at the height of 1 metre remained all unaffected. The author believes that this fact suggests that, if an insect is the transmitting agent of *Tox. cuniculi*, then this insect can only move about at relatively low heights and that it is probably wingless.

The symptoms are those of a profuse anaemia and inappetence, followed later by paralysis just before death. On post-mortem examination one finds a yellowish exudate in the peritoneal cavity, very considerable enlargement of the spleen, which is covered with whitish spots and ecchymosed, and the liver as well as the lungs are covered with similar spots, which, at first sight closely resemble miliary tubercles. The blood shows basophilia and lymphocytosis, but no parasite was found in the peripheral circulation.

Smears from the spleen stained with Giemsa showed up quite easily the typical parasite of SPLENDORE. Beside the characteristic crescentic forms the author discovered more or less spherical organisms. The average length of the parasite was from 6 to 7 microns although certain forms undergoing division attained 21 microns in length. The position of the nucleus is very irregular; it may be central, terminal, or in some intermediate position. One or two chromatin granules were sometimes found within it.



The parasite is found in the large mononuclear cells of the spleen, and in some of these cells it may be seen undergoing a process of division by schizogony. At a certain stage the large mononuclear cell, whose nucleus has been pushed towards the circumference, becomes broken up, and young merozoites are set free (see the two figs.\* on right of lower line). Forms up to 21 microns in diameter were seen, more or less circular in outline, and containing a large number of nuclei. The author could not find the remains of the nucleus of the large mononuclear cell in them and so inferred that these large forms of the protozoon are in reality schizonts. The protoplasm of the parasite is very irregularly stained by Giemsa; in some cases it stains an intense blue, in other cases it does not stain at all.

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## PARASITOLOGY.

## (a) HELMINTHIASIS.

- (185) DESCAZEUX (M. J.). Contribution à l'étude de l' "esponja" ou plaies d'été des Equidés du Brésil. ["Esponja" or "Summer Sores" of Equines in Brazil. (RAILLIET's Report of a Commission to the Soc. Cent. de Méd. Vét. 17 June 1915).]—*Rec. de Méd. Vét.* 1915. Jan. 30 to Sept. 30. Vol. 91. Nos. 19-20. pp. 468-486. With 3 text-figs.

In this report Railliet analyses the whole question of "summer sores" of equines, basing his conclusions chiefly on information collected by Descazeaux, who has studied the disease in Brazil.

A very clear and concise description is first given of the clinical characters and morbid anatomy of the disease, particularly as it occurs in Brazil. The granular dermatitis is stated to present numerous variations in its characters according to the countries in which it is observed, as for example in India, Africa, Oceania, and in tropical America.

The report is mainly of importance in that it throws new light on the etiology of summer sores. It is well known that in numerous observations the presence of a nematode has been determined in the granulations of "summer sores," but our clinical knowledge is not yet so precise that one can differentiate, by means of a simple external examination, between verminous dermatitis and dermatites attributable to other elements than worms. It is thus that in India one still often confuses, under the name of *bursati* or *bursattee*, cutaneous lesions caused by moulds and by nematodes.

ERCOLANI was the first to discover, in 1859, a larval nematode in the loose fibrous tissue at the base of the newly formed "umbilicate scabs" and he remarked that this larva bore a good deal of resemblance to the embryos of *Spiroptera megastoma* (now called *Habronema megastoma*). More detailed descriptions have lately been given of this parasite by BUFFARD, RIVOLTA, and FAYET and MOREAU.

Descazeaux obtained the nematodes from granulations about 15 to 20 days after their first appearance. A piece of non-calcified granulating tissue was thus placed on a slide with a drop of 0.2 per cent. hydrochloric acid. After about five minutes the tissue is broken up by means of coarse dissection with a pair of fine needles. One looks under the microscope in the dissociated pieces for the presence of the nematode and a head or a tail is found pretty easily. One then retains only the small piece of tissue containing the parasite, keeping a watch on its dissolution and helping it by means of cautious dilaceration, for the worm is easily broken. As soon as the latter is isolated the slide is dried and the specimen covered with a cover glass. A drop or two of lactophenol is introduced between the slide and cover glass, and the latter is then bordered with paraffin wax.

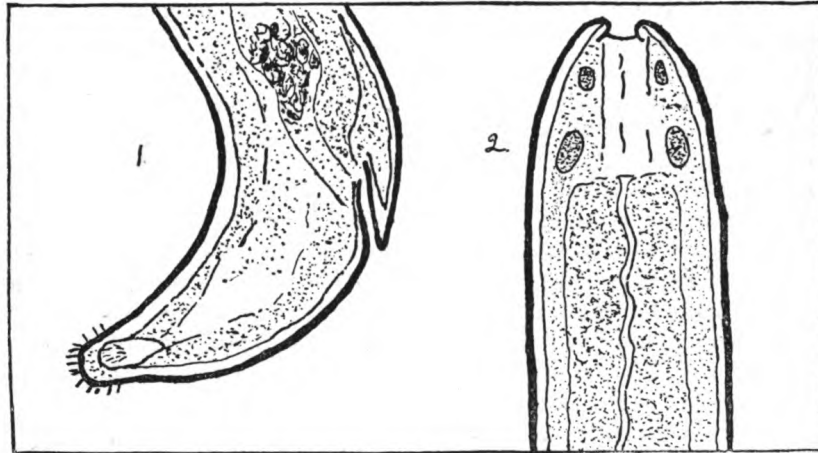
Descazeaux describes two kinds of parasite, viz. :—

(A) *Constant parasite*.—"Asexual" nematode, 2 mm. long by 45 to 50 microns broad. Cylindrical, filiform, slightly flattened body, thinner at its anterior extremity and terminating posteriorly in a blunt end covered with bristles; elongated intestine; flexuous uterus which "seems" to contain spherical eggs from 5 to 6 microns in diameter.



(B) *Inconstant parasite*.—This was discovered in one sore only out of more than ten examined, and was described as an “asexual worm” 900 to 950 microns long by 25 microns broad; elongated, cylindrical body, slightly thinner in front and terminating in a sharp drawn-out point. Said to contain a bifurcated uterus full of elongated eggs.

Railliet maintains that Descazeaux has here committed the same mistake as other authors, such as FAYET and MOREAU, in that he mistook the cells of the intestinal wall for eggs. One knows of no nematode possessing eggs of from 5 to 6 microns in diameter, so that the alleged uteri which he describes are, in reality, inexistent.



Larva A.—1, posterior extremity showing end covered with tuft of bristles, and above and to the right, the anus; 2, anterior extremity showing mouth, vestibule or pharynx, and oesophagus with tortuous lumen.\*

Railliet considers that the presence of the tuft of bristles at the extremity of the tail in the larval form (A), corresponding with what RIVOLTA had also previously described at the caudal extremity of his parasite, is of fundamental importance in that it enables one to determine approximately the classification of the nematode of “summer sores.” Larvae with bristly tails have already been observed in a large number of animals—insects, etc.—and have been lately given a new name—*Agamospirura*—by HENRY and SISOFF to indicate their origin. They represent in reality the larvae of nematodes commonly designated under the name of *Spiroptera* (suborder *Spirurata* or super-family *Spiruroidea*).

In searching for the adult form of the larva of “summer sores,” one can thus limit the field to the only genus of spiruroidea of which we know representatives in the horse, viz., the genus *Habronema* (Dies). The three species of spiroptera parasitic in equines belong to this genus, viz., *Habronema megastoma* (Rud.), *H. microstoma* (Schneid.), and *H. muscae* (Carter).

The evolution of the last named of these species has been described by RANSOM, and in his report Railliet summarises this evolution. As far back as 1861 CARTER, had found a larval nematode in the proboscis, head, and abdomen of the domestic fly. RANSOM showed that this larva

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belonged to a spiroptera, *H. muscae*, which lives in the stomach of the horse; the embryos evacuated with the faeces penetrate into the larvae of flies (living on horse manure), undergo development in these larvae, as well as in the pupae and fully formed insects, and finally reach the adult state in the stomach of the horse, when the flies are ingested by this animal. Besides the initial embryo and free-living form, RANSOM was able to distinguish six stages in the development of the larva within the body of the fly.

These stages, separated from one another by a moult, took place, the first two in the pupae or larvae, and the others in the winged fly. The nematode larvae increase in size from 400 to 450 microns in the first stage up to 2 mm. in length in the sixth or last stage. The bristles appear at the end of the tail in the fifth stage. The last stage of evolution in the fly is the first in the horse's stomach, where RANSOM collected it from among other forms more advanced in development and even adults. After about four or five moults in the stomach the worm reaches its adult state; the tail bristles are present after the first stage in the stomach but disappear afterwards.

The method of infection in the horse has not been accurately determined, but perhaps the larva escapes from the fly's proboscis while it feeds on the moist lips of the animal, or perhaps the horse also is infected by swallowing living or dead flies. The various forms of nematode described by different observers would correspond with the embryos or one or other of the larval stages of *Habronema*.

As regards the method of penetration of these larvae through the horse's skin, one is as yet limited to hypotheses. RIVOLTA believed that the penetration was from without inwards, and that it was favoured by the dirty condition of the animals and of stables. Descazeaux shares this view because he noticed that the "esponjas" are confined for the most part to the lower part of the limbs, and that certain ordinary wounds may at the end of a certain time become transformed into "esponjas." On the other hand LAULANÉ noticed the arterioles of the dermis in course of obliteration and thus thought that the parasite was conveyed in the circulating blood. Also, LINGARD in India, whilst studying "*Bursati*" which he attributed to embryos circulating in the blood, pointed out that the presence of the characteristic granulations of these lesions was observed before the formation of an ulcer. One knows, however, that the larvae of *Ankylostoma* and *Strongyloidea* are able to penetrate through the skin of mammals without leaving any apparent traces of their passage.

Railliet is inclined to think that the nematodes penetrate from without inwards in the following manner. The *Habronema* embryos are thrown into the outside world with the excreta of the horse; they then penetrate through the skin of the animal in the same way as the larvae of *Ankylostoma*, there setting up an irritation which may lead, by rubbing or scraping, etc., to the formation of a sore which takes on from presence of these larvae its particular characteristics. They develop as erratic parasites in this abnormal medium and undergo in it an evolution analogous to that which they normally accomplish in the body of the fly.

*Treatment.* Up to the present the *Spiroptera* have been looked upon as almost inoffensive parasites of the horse's stomach and no attempts are usually made to get rid of them. One knows now,

however, that the nematode of "summer sores" belongs to the cycle of evolution of one or several kinds of these parasites. Thus *a priori* the solution of the problem lies in the expulsion of these parasites from the horse's stomach, and one might try experiments in the use of tartar emetic or arsenious acid for this purpose.

Various medicaments employed locally have been of little or no use in the treatment of the disease, except that Descazeaux states that he obtained good results by rubbing the sores with 2 to 3 per cent. solutions of trypanblue. The only effective treatment is, however, the early and complete excision of the infected tissues.

(184) MIGONE (L. E.). **Parasitologie de certains animaux du Paraguay.** [Parasitology of Certain Animals of Paraguay.]—*Bull. Soc. Path. Exot.* 1916. June. Vol. 9. No. 6. pp. 359-364.

The chief parasites are *Haemogregarinae*, *Trypanosoma*, *Microfilaria*, *Myxosporidia*, and a parasite not well understood at present, *Linguatula*.

The author gives a list of birds, fishes, reptiles, and mammals with short descriptions of the parasites found in the blood and tissues of each. From his observations he deduces that there exist, in South America, parasites identical with those already known in the old world and in the other countries of America.

*Linguatulae*. When one finds a fish affected, one observes at first sight in the abdominal cavity numerous linguatulae and cysts of small linguatulae. The peritoneum, mesentery, and parietal peritoneum are all affected with these parasites. This arthropod penetrates through the intestinal canal, its head always being directed towards the peritoneal cavity. Alongside the well-developed parasites from 1 to 3 centimetres long there are numerous cysts 1 to 3 mm. in diameter containing a little liquid and a small worm completely formed with its pseudo-articulations and hooks. The author believes that the parasite is *Linguatula serrata*. The parasite is also encountered in mammals which feed on the dead fish commonly found on the borders of streams and dried up lakes.

(b) ACARIASIS.

(185) SHILSTON (A. W.). **Sheep Scab. Observations on the Life-History of *Psoroptes communis* Var. *ovis*, and some Points connected with the Epizootiology of the Disease in South Africa.**—*Union of South Africa. Dept. of Agric. 3rd & 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 69-98. Pretoria: Govt. Printing & Stationery Office.

Practically the whole of our knowledge of the life-history of the acarus of sheep scab has been derived from investigators who recorded their observations over 50 years ago, notably GERLACH (1857). The observations of STOCKMAN were published while the experiments recorded by the author were in progress.

Very little attempt has been made to find out whether the life cycle of the sheep scab acarus differs in countries with widely different climatic conditions. Hence, a series of extremely interesting experiments were carried out by Shilston in which the complete life cycle of the parasite in South Africa was worked out.

In order to watch the development of the psoropt in its various phases on sheep the following technique is employed. The small patch of skin on which the parasites are to be deposited is carefully washed and shaved, and a glass cylinder three inches high by two inches in diameter is placed on it and secured around its base by means of melted wax. Its open end is tied over with a piece of muslin to prevent escape of the parasites; the adjoining locks of wool are then securely tied over the cylinder to prevent slipping. The parasites were moved on to a fresh spot every three or four days.

*Life History on Sheep.*—The weather has very little effect on the duration of the life cycle. It never occupies more than 10 days and in the great majority of cases it is complete in 9 days. The eggs usually hatch out after an interval of two days. The larval stage is short, nymphae usually appear 48 hours after hatching of the eggs and always within three days. The nymphal stage lasts from three to four days. Pubescent females always appear before males. The former were observed  $5\frac{1}{2}$  days after the hatching of the eggs but the latter were never seen earlier than the sixth day. The females are three or sometimes four times as numerous as the males. After feeding for a short time copulation takes place which lasts for about 24 hours. After moulting the ovigerous female is then formed, and it may commence to lay eggs 24 hours after this last moulting, that is, nine days from the time of hatching of the larva from the egg.

It is rather difficult to find out the number of eggs which can be laid by a female. In a number of observations it was found that a single female is capable of laying up to 100 eggs, but that the number laid depends largely on weather conditions. Laying usually commences on the 9th day and may continue up to the 38th day. The life of the ovigerous female on the sheep is from 30 to 40 days.

The longest period over which an unfertilised female was kept alive on a sheep was seven weeks, though the majority of such parasites died three or four weeks after moulting from nymphae. Male acari lived for periods varying from 22 to 34 days after moulting from nymphae.

*Factors in the Epizootiology of Sheep Scab bearing on the Question of Eradication.*—A single dipping is known to fail to cure scab owing to the escape of the eggs. The life-cycle being complete in nine days, dipping should thus be repeated in 10 days at the most. An extra day may be allowed because the fleece usually remains wet for a day after the first dipping. Owing to the protection of crusts, even adult parasites may be allowed to survive two immersions, hence a third dipping ten or fourteen days after the second would greatly increase the chance of a complete cure.

A number of observations were made to ascertain the length of time acari and their eggs can retain their vitality apart from sheep. In crusts and wool kept at room temperature the acari begin to die in three or four days, the young forms first, and are generally all dead in 16 days after removal from the sheep.

When kept moist at body temperature ( $37^{\circ}$  C.) in an incubator the acari are very active for two or three days and eggs present in the crusts hatch. A day or two later the larvae and most of the older forms die and very few survive more than six or seven days.

At  $0^{\circ}$  C. all forms were dead in four days.

Eggs kept at air temperature for up to, and including, eight days after being laid, hatched out when placed on sheep; after nine days removal one egg hatched out of 20, and after longer periods not one hatched. In an ice box the eggs retained their vitality for 10 days, but after 12 days all failed to hatch. It is thus no longer possible to regard the eggs of acari as being capable of maintaining their vitality for long periods apart from sheep and thus accounting for the persistence of the disease in kraals, etc.

The following table gives the results of experiments undertaken to show the period over which infection with sheep scab parasites may persist :—

Expt. No.	Particulars of Infection.	Interval between Removal of Infected Sheep from Kraal and Contact with Clean Sheep.	Length of time Clean Sheep remained in Contact.	Result.
1	37 Scabby sheep herded in Kraal for 44 days	21 days	76 days	Sheep clean.
2	30 Scabby sheep herded in kraal for 48 days	60 days	16 days	Sheep clean.
3	Do.	90 days	7 days	Sheep clean.
4	37 Scabby sheep herded in kraal for 35 days	10 days	60 days	Sheep clean.
5	Infected sheep running in a kraal for several months	24 days	48 days	Sheep clean.
6	Wool crusts and acari spread in box	Box kept free of sheep for 20 days	4 months	Sheep clean.
7	Acari and pieces of fleece scattered in box	Box kept free of sheep for 15 days	4 months	Sheep clean.
8	Manure collected from a kraal in which infected sheep had been running up to 16 days previously	Clean sheep immediately put into :— (a) clean kraal with manure, (b) above sheep removed after five days and replaced by second lot of clean sheep	5 days 6 months	Sheep infected. Sheep clean.
9	2 Scabby sheep running in a pen for 7 weeks. At the time of removal, pieces of fleece and acari were spread on floor of pen	8 days	4 months	Sheep clean.
10	Do.	12 days	4 months	Sheep clean.

From the above it can be seen that acari are unable to live for more than four weeks apart from sheep.

Investigations showed that the psoroptes causing scab and otacariasis in goats and rabbits could not cause scab in sheep. The converse was equally true.

*Variations in the Rapidity of Multiplication of the Acari.*—As in Great Britain, great variations in the prevalence of sheep scab in the course of the year are also observable in South Africa. On scabby sheep, maintained at the Laboratory to supply material for experiments, the number of acari was noted to diminish in the spring of each year until, later, they could only be found with considerable difficulty. It is also well known to sheep farmers in very dry areas that, in certain seasons of the year, flocks that have been badly infected may become apparently clean and remain so without any kind of treatment being carried out. When on account of drought the sheep lose condition scab again makes its appearance, although no opportunity for re-infection may have occurred in the meantime.

With sheep in good condition it is frequently found difficult or even impossible to transmit the disease by infection with acari. "In carrying out the observations on the life-history of acari it was frequently noticed that development occurred just as rapidly on the washed and shaven patches on affected sheep as on those in poor condition, but when the covers were removed and when the parasites were allowed to spread to the surrounding skin multiplication was much more rapid in the case of the thin sheep than on those with excess of yolk in their fleece, while in a few of the latter no development occurred at all."

In order to observe the *effect upon the acari of the presence of wool fat*, two patches were prepared on the same sheep; one was washed and shaved in the usual way, but on the other the wool was only cut short and in addition the patch was smeared with "yolk" obtained from the wool of another sheep. On each patch six ovigerous female acari were placed. It was seen that in both cases eggs were laid on the following day and larvae were present on the fourth day.

On the ungreased patch the development occurred as usual, eggs being laid nine days after the appearance of the larvae, and this cycle was continued for several generations. As each generation of acari began to develop on the ungreased patch, a number of the young forms was removed to a fresh area so that the number of generations could be determined.

On the greased patch, however, the majority of the larvae died two or three days after hatching, while those that survived developed very slowly; thus it was not till 14 days after hatching that adult male and female acari were observed, and although fertilisation took place no eggs were laid, and living acari were not observed after the 21st day from the time of hatching. By this time the fourth generation of acari were developing on the ungreased area.

When the skin was greased very slightly the acari developed as rapidly as on the ungreased area. In these cases, the growing wool lifted the first crusts formed and these carried the fat with them so that the acari were able to live on the dry skin underneath. However, when sufficient grease was present to soak down under the crusts development was very slow and in every case the acari gradually died out, usually in about 20 days.

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## MYCOLOGY.

## (a) ASPERGILLOSIS.

- (188) WALKER (J.). **Aspergillosis in the Ostrich Chick.** (Synonyms: **Yellow Liver, Chick Fever**).—*Union of South Africa. Dept. of Agric., 3rd & 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 533-574. With 5 charts & 2 plates, comprising 7 figs. Pretoria: Govt. Printing & Stationery Office.

Chick Fever or Yellow Liver among ostrich chicks reared on some farms in South Africa sometimes causes a mortality as high as 70 per cent. The disease has thus assumed considerable economic importance, inasmuch as prices as high as £200 to £300 may be paid for adults, and £30 for three month-old chicks.

In preliminary observations the author discovered that various moulds, notably of the *Aspergillus* type, were found in the lesions of chick fever and, in exposure experiments, were capable of transmitting the disease.

On a plan outlined by the Director of Veterinary Research of the Union of South Africa, the author carried out further detailed investigations into the nature of the disease, the results of which are summarised in the following conclusions:—

“1. *Aspergillus fumigatus* appears in the ostrich, more particularly in the ostrich chick, from a few days to about 3-4 weeks after hatching, and is responsible for the disease in ostrich chicks commonly known as ‘Yellow Liver or Chick Fever.’

“2. *Aspergillus fumigatus* is the commoner and more pathogenic species.

“3. Outbreaks usually appear in an epidemic form and are more prevalent amongst chicks artificially hatched and reared.

“4. *Aspergillus fumigatus* infection occurs in the air chamber of the egg, and is common in straw and other vegetable matter and in soil which has been fertilized with decomposed vegetable matter, such as stable manure, etc.

“5. Infected eggs are the chief source of infection of incubators, the liberation of *Aspergillus fumigatus* from the air-chamber taking place either at the time of hatching or when infected eggs are opened in the incubators.

“6. Aspergillosis is contracted naturally from:—

“(a) Infected eggs just previous to or at time of hatching.

“(b) Infected bedding used in chicks’ sleeping boxes.

“(c) Infected incubators.

“7. Aspergillosis may be transmitted artificially by inhalation and ingestion and intravenous inoculation of cultures.

“8. *Aspergillus* infection occurs chiefly through the respiratory tract, the lungs and air-sacs being the seat of infection.

“9. Infection may occur through the digestive tract.

“10. *Aspergillus fumigatus* is transmitted from infected to clean eggs through the unbroken shell.

“11. The contents of unbroken eggs may escape through the intact shell. In such cases the bacteria which exist in the contents are probably a source of infection of eggs, more particularly those in contact.

“12. Spores of *Aspergillus fumigatus* vegetate after passing through the intestinal canal.

“Prevention consists in the use of:—

“(1) Non-infected incubators.

“(2) Non-infected bedding in the chicks’ sleeping boxes.

“(3) Non-infected eggs for incubation purposes.

“Boiling water has given satisfactory results in the sterilization of cultures of *Aspergillus fumigatus*.”

## (b) CRYPTOCOCCOSIS.

- (189) MONOD (T.) & VELU. **Sur la lymphangite épizootique au Maroc.** [Epizootic Lymphangitis in Morocco.]—*Rec. de Méd. Vét.* 1915. Oct. Vol. 91. No. 18. pp. 631-638. With 4 figs.

(1) *Recurrent attacks of epizootic lymphangitis.*—The authors have never seen cases of re-infection, but on the other hand have observed local delayed relapses equivalent to re-infections. Four cases are detailed in which relapses occurred from three to six months after apparently complete recovery from a previous infection.

(2) *Osseous lesions in epizootic lymphangitis.*—Extra-cutaneous lesions are often secondary and the associated abscesses in those cases facilitate diagnosis, or they may be complications of the lymphangitis. In rarer cases these extra-cutaneous lesions may be the only cryptococcic localisations clinically discoverable.

Osseous cryptococcosis was found in 17 out of 159 cases treated in the course of a year. Hitherto, the cryptococcus was not suspected to be the causal agent of these lesions, but it appears in reality to exert a predilection for bony tissues.

Clinically one can distinguish (1) ostites associated with cutaneous lesions and (2) primary ostites.

A description of 17 cases, with photographs of four lesions, is given, in which lesions of localised and diffuse suppurative periostitis, periostoses, suppurative osteomyelitis, hypertrophying ostitis and spontaneous fracture are described, involving various bones such as the maxillae, scapula, sternum and the pelvis. These lesions simulated all the forms of chronic ostitis due to other causes, and might be easily confused with them. The evolution of these cryptococcic ostites is always chronic, and they are most often post-traumatic lesions.

Diagnosis is difficult and can only be settled by means of the microscope.

Prognosis.—Bony lesions constitute the most serious and most refractory of all the localisations. Out of 20 cases of epizootic lymphangitis slaughtered as incurable in a year, 13 had bony lesions.

Treatment should be the same as in cases of typical epizootic lymphangitis. Surgical intervention is only indicated in cases where a sequestrum is formed and good results are then obtained in three cases out of every four. The successful results hitherto obtained in these cases by excision caused one to overlook the fact that the lesions were in reality cryptococcic in origin.

- (190) BRIDRÉ (J.). **La lymphangite épizootique en France ; diagnostic et traitement.** [Epizootic Lymphangitis in France ; Diagnosis and Treatment.]—*Rec. de Méd. Vét.* 1916. Apr. 30. Vol. 91. No. 8. pp. 136-142. With 1 coloured plate.

As a result of the war several diseases, which from their rarity in times of peace had been classified as exotics, have made their appearance in France. Epizootic lymphangitis was observed at the beginning of the campaign in horses belonging to Moroccan cavalry, and there is reason to believe that the disease is African in origin when one considers



its frequency in the French possessions in Northern Africa. The number of cases of the disease that passed through a depôt seems quite inconsiderable, but the diversity in origin of these cases indicates a rather disquieting diffusion. The disease at present also attacks horses which are civilian property and certain stables appear to be severely affected.

The author describes the diagnosis of the disease and its differentiation from ulcerative lymphangitis (due to the Preisz-Nocard bacillus), and sporotrichosis.

*Treatment.*—NÈGRE, TROUETTE, and the author have previously published observations on the treatment of this disease by means of intravenous injections of *arsenobenzol*, which they claimed to have furnished excellent results [*Bull. Soc. Path. Exot.*, 1911; *Ann. Inst. Past.*, 1912]. In current practice its employment, however, presents some difficulty on account of the material necessary for the preparation of the solutions and injections.

*Novarsenobenzol*, which gives exactly the same results as the old *arsenobenzol*, is on the other hand easy to administer. The author recommends a dose of from 2 to 3 grammes dissolved in 20 cc. of distilled water to be injected into the jugular.

“Care should be taken not to allow the escape of fluid subcutaneously as the substance produces a great deal of irritation and pain in the subcutaneous tissues. The effects of the injection are shown afterwards by the cicatrization of the original ulcers, the diminution in size of the lymphatics, the appearance of new ‘buds’ on the diseased lymphatic system, the softening and spontaneous opening of existing ‘buds.’ The ‘bud’ seems to react by expelling the parasite.

“In order to appreciate the results of the injection it is as well to wait three weeks. A cure is then assured if the cording of the lymphatics has disappeared or considerably diminished, if they have become painless to the touch, and if the original wound is cicatrised. If, on the other hand, the original wound remains open and the sensitiveness of the lymphatics persists it is better to repeat the injection.

“It is sometimes advisable to puncture, by means of a bistoury or cautery, certain abscesses in which spontaneous bursting would otherwise be too long delayed, and to assist the cicatrization of extensive ulcers by painting them with tincture of iodine. Considerably granulating ulcers should be powdered over with copper sulphate or liquid chloride of zinc.”

The author then gives details of nine cases treated as above, all terminating in complete recovery, except one, where, owing to the advanced state of the disease when first treated, recovery was only partial.

(191) DOUVILLE. **Traitement de la lymphangite épizootique. Essais par le galyl.** [Treatment of Epizootic Lymphangitis. Experiments with Galyl.]—*Rec. de Méd. Vét.* 1916. May 30 to June 30. Vol. 91. Nos. 11–12. pp. 144–151. With 4 plates.

Galyl is a definite chemical compound, an organic arsenio-phosphate discovered by Professor MONNEYRAT (formula  $C_{24}H_{22}O_8N_4P_2As_4$ ). Its employment in human medicine for the treatment of syphilis, relapsing fever, and yaws has been recently studied by various authors, while LAVERAN and ROUDSKY in 1913 published experiments to show that the compound was very effective in infections due to *T. brucei*, *T. evansi*, *T. rhodesiense*, and *T. soudanense*. Galyl has the

form of a yellow powder which keeps indefinitely in a closed flask. Its molecule contains 35 per cent. of arsenic and 7.2 per cent. of phosphorus. It is easily soluble in water, forming a transparent yellow or slightly brownish solution.

The author utilised, to commence with, the system of giving fractional doses; an intravenous injection of 90 cg. or a gramme, in a  $\frac{3}{4}$  or 1 per cent. solution, being repeated weekly as a rule. Up to 5 grammes, however, of galyl can be tolerated by a horse of average weight without any risk. At present the author gives a preliminary injection of 2 or 3 grammes of the product, according to the extent of the lesions and the size of the patient, and waits a fortnight before repeating the injection. In cases where improvement occurs the second dose does not exceed 1.5 or 2 grammes; in the contrary event, it is equal to the first injection.

All the cases treated by the author with galyl were chosen from amongst the most severely affected and from those cases where effective cauterisation of the lesions could not be applied without risk. The author then gives a history of 15 cases so treated. Eleven cases were completely cured, the total dosage for each having varied from between 3 to 6 grammes and the duration of the treatment from one to three months. Four animals were killed after a month in hospital on account of the extent and severity of the lesions. In the case of these latter animals, the dose injected did not exceed 3.5 grammes, but the author believes that these animals would have remained refractory to a larger quantity of the product. The animals were slaughtered for economic reasons.

Comparatively, the author has tried treatment with *iodides*, which TEPPAZ utilised for the same infection in Senegal. A certain amelioration was observed in the case of treated animals, but in no case could a cure be said to have been effected, although a total dosage of 300 grammes had been given to some animals.

Treatment with *novarsenobenzol*, recommended by BRIDRÉ, was also thus tried. In 12 cases treated, seven animals appeared to be on the road to recovery after having each received an injection of 3 to 6 grammes in the course of a month. In the case of the other five, the lesions seemed to be stationary in spite of the administration of 5 to 11 grammes of the product.

(192) VELU. **Essai de traitement de la lymphangite épizootique par le novarsénobenzol.** [Treatment of Epizootic Lymphangitis with Novarsenobenzol.]—*Rec. de Méd. Vét.* 1916. May 30 to June 30. Vol. 91. Nos. 11-12. pp. 152-155.

The author has had ample opportunity of comparing the effect of various drugs on the very numerous cases of epizootic lymphangitis which occur in Morocco. Contrary to the indications of BRIDRÉ and other workers, who have claimed most favourable results from treatment with *novarsenobenzol*, the author has found that in his hands this product has given no better results than in the case of the other products hitherto employed, in particular colloidal iodine and biniodide of mercury.

## (c) SPOROTRICHOSIS.

- (193) BRIDRÉ (J.). **Sur un cas de sporotrichose du cheval.** [A Case of Sporotrichosis in the Horse.]—*Rec. de Méd. Vét.* 1916. Apr. 30. Vol. 91. pp. 113 to 116.

The author describes a case of the above disease in a French army horse imported from North America. Sporotrichosis of the horse was observed for the first time in 1909 in Madagascar by CAROUGEAU, and has been found in America by various authors, but up to the present no cases have been reported as occurring in France.

The following were the lesions presented by Bridré's case :—

“Excoriation of the left eyebrow; a circular ulcer with edges radially striated at the base of the left ear, and from this ulcer commences a cord-like beaded swelling, with hard and insensitive ‘buds,’ ending at the entrance to the chest; several buds opened by means of a scalpel disclosed a thick cream-like pus. The animal was placed in a box when these symptoms were first seen and tested with mallein, subcutaneously, but gave no reaction. On the following days the wounds on the eyebrow and at the base of the ear showed a tendency to cicatrisation.”

Microscopic examination of fresh pus showed two oblong bodies only, bearing some resemblance to cryptococci, but not showing the characteristic refractile envelope of these parasites. The material was sown on to Sabouraud's agar immediately and kept at room temperature. After about 12 days numerous colonies of *Sporotrichum* appeared on the surface of the agar.

At first sight the characters of this organism did not appear to differ sensibly from those of *S. beurmanni*. A precise description is promised by the author's friend, PINOY, who has commenced the study of the organism.

The above case was treated by intravenous injections of novarsenbenzol, with successful results.

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 BACTERIAL DISEASES.

## UNDULANT FEVER.

- (194) IZAR (Guido). **Mutazioni morfologiche culturali e biologiche *in vitro* ed *in vivo* del micrococco di Bruce per azioni dei sali di chinino. Nota Preventiva.** [Morphological, Cultural and Biological Changes *in vitro* and *in vivo* of Bruce's Micrococcus, caused through the Action of Quinine Salts. Preliminary Note.]—*Pathologica.* 1916. June 1. Vol. 8. No. 182. pp. 175-176.

By the addition of gradually increasing quantities of quinine salts to media, Bruce's micrococcus can become accustomed to, and grow luxuriantly on, media containing several times the dose that would be bactericidal to the original strain.

Thus acclimatised it displays the following changes :—(A) Morphological—(increase in size, chain and bacillary forms); (B) Cultural—(a greater rapidity of growth, a dense whitish film on surface growth); and (C) Biological—(loss of agglutinability towards serum immune

against the original strain of micrococcus, increase of non-specific agglutinability, but specific agglutinability towards an auto-immune serum persists).

The sera of individuals who had undergone quinine treatment and were affected with a low form of Malta fever did not agglutinate the ordinary strains of the micrococcus; they, however, agglutinated the micrococcus which had grown for several generations on media containing quinine.

The author believes that his strain acclimatised to quinine resembles the *γ*aramelitensis strain of NÈGRE and RÉNAUD.

- (195) SERGENT (Edm.), NÈGRE (L.) & BORIES (L.). **Epidémie de fièvre ondulante à Arzew et Saint-Leu (Dep. d'Oran, Algérie) en 1915.** [An Outbreak of Undulant Fever in Arzew and Saint-Leu (Dept. of Oran, Algeria) in 1915.]—*Bull. Soc. Path. Exot.* June. 1916. Vol. 9. no. 6. pp. 351-356. With 4 charts.

The department of Oran has always been an active focus of undulant fever although in the departments of Algiers and Constantine the disease has now been reduced to insignificant proportions. In the spring of the year 1915 a further increase in severity of undulant fever, which lent some particularly interesting characters to the circumstances, took place in the localities of Arzew and Saint-Leu. The epidemic broke out from February to May and affected 20 people—13 soldiers out of a total of about 10,000 men, and 7 civilians out of a population of a corresponding number. With the exception of three cases in which the blood was not taken, serodiagnoses were positive—after heating the serum to 56 C. for half an hour—to a high degree: 1/500 and 1/1,000.

The principal symptoms and complications observed in the case of each patient are given by the authors in tabular form.

It is noteworthy that two patients out of 17 had not partaken of unboiled milk or of fresh goat cheese. Six out of 17 did not drink unboiled goat's milk but ate fresh cheese, while 9 out of 17 took raw milk or fresh goat cheese. The duration of the disease varied from 35 days up to 6½ months, and three deaths occurred.

The disease was most serious in the case of the soldiers, since all the deaths took place among them and nearly all the others were incapacitated for a long time.

SERGENT (Edm.) and BORIES found in 1907 that samples of goats' milk gave a positive agglutination in the proportion of 3·3 per cent., and likewise the sera of six other animals (horses, asses, dogs). SÉJOURNANT also made the same observations in 1912. The domesticated animals of this region thus appear to harbour the *M. melitensis* in an enzootic state.

The increase of the epidemic in 1915 was particularly severe, probably because it found a favourable medium in the soldiers who had been rendered more sensitive by change of environment and physical fatigue.

W. H. HORROCKS and the English medical men in Gibraltar have shown that this English possession, contaminated by goats from Malta, contaminated in its turn the neighbouring Spanish towns. In these circumstances, it would appear necessary in the presence of this

persistence of undulant fever in Orania to introduce legislation against the importation into Algeria of goats from Spain, or at least submit them to a careful bacteriological examination.

(b) D'HÉRELLE'S BACILLUS FOR EXTERMINATION OF LOCUSTS.

- (196) MONOD & VELU. **Note préliminaire sur la destruction des acridiens par l'emploi des cultures microbiennes.** (Laboratoire du Service Zootechnique et des Epizooties au Maroc.) [A Preliminary Note on the Destruction of Acridians by means of Bacterial Cultures.]—*Rec. de Méd. Vét.* 1916. June 15. Vol. 92. No. 10. pp. 346-348.

D'HÉRELLE isolated in 1910, from an outbreak of disease among locusts in Mexico, a coccobacillus which was very pathogenic for these insects. The authors have undertaken experiments in certain parts of Morocco with a view to the extermination of locusts by infecting them with this organism, and the results are briefly summarised as follows.

D'HÉRELLE'S method provokes very contagious outbreaks among insects either by the dissemination of broth cultures or by contamination with the aid of infected crickets. The contagious enteritis provoked by the coccobacillus among the crickets behaves in the same manner as other epizootic diseases. After a period of incubation one observes a period in which a variable mortality occurs; then a period of decline sets in with a diminution of morbidity, caused either by attenuation of the virulence of the organism or by increase of resistance of individuals. In the most favourable cases one notices a mortality of 70 to 80 per cent. In other cases the mortality does not exceed 20 to 25 per cent.

D'HÉRELLE'S method is very difficult of application, and good results can only be obtained by competent technicians. Moreover, unfavourable atmospheric conditions such as rain, heavy dews, or bright sunlight considerably hamper the efficacy of the method. It would also be difficult to spread pure broth cultures over a large extent of territory.

The results, however, have been very encouraging and the authors are prepared to adopt the method on a large scale when future invasions by locusts occur.

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DISEASES DUE TO ULTRA-VISIBLE VIRUSES.

(a) VARIOLA.

- (197) (1) MONOD & VELU. **La variole des porcelets au Maroc. Premiers essais de vaccination.** [Variola of Young Pigs in Morocco. First Attempts at Vaccination.]—*Rec. de Méd. Vét.* 1915. Sept. 15. Vol. 91. No. 17. pp. 570-573.
- (2) VELU. **Contribution à l'étude de l'étiologie de la variole des porcelets.** [The Etiology of the Variola of Young Pigs.]—*Ibid.* 1916. Jan. 15 to Feb. 15. Vol. 92. Nos. 1 & 2. pp. 24-27.
- (3) VELU. **Recherches expérimentales sur la variole des porcelets.** [Experiments on the Variola of Young Pigs.]—*Ibid.*, pp. 28-30.

In these three short essays a description is given of the authors' observations and work on the variola of young pigs in Morocco.

The disease is very common in that country and causes considerable ravages among young pigs.

According to POENARU, the disease has been demonstrated to be due to a filterable virus. BOLLINGER states that it may emanate from either cow-pox or sheep-pox, thus producing local or general symptoms respectively. PEIPER states that small-pox of man is transmissible to the pig, and vice versa. The authors, however, state that no sheep-pox or human small-pox existed in districts where the variola of pigs occurred, and that though no precautions were taken in handling the sick the disease was not transmitted to human beings; and also, laboratory experiments showed that the infection of young pigs with pig variola did not give subsequent protection against the infection with cow-pox virus.

The virulence of the disease is very variable. The mortality ranges between 5 and 80 per cent., and the virulence in the course of several years apparently undergoes increasing modifications, that is exaltations and attenuations, giving rise to various degrees of illness (benign, generalised, and septicaemic forms). The reason for this is not known. The disease occurs in all seasons, but more especially in winter. The virus is known to be preserved in the dried-up crusts that are shed from the skin, and this probably explains the annual re-appearance of the variola in infected piggeries during the farrowing season.

Up to the age of 3 or 4 weeks, young pigs are so susceptible that nearly all are attacked during an outbreak. After the age of 2 months they often remain insusceptible, whilst one very rarely meets infections of adults. In the latter case, the disease is always very benign and localised about the teats and ears, and is caused, no doubt, by the sucking pigs.

The rabbit, the guinea-pig, and the rat are immune.

Most of the body tissues of an infected animal are virulent, but the cutaneous lesions seem most apt to transmit the infection. The virus is abundant in the eruptions immediately papules are formed, and it still exists when the secretions become purulent.

The patient itself is the most important factor in the transmission of the disease, but this does not explain the appearance of outbreaks with no direct history of original contagion or apparent importation. It sometimes appears that dust may be an important factor, and the authors have known instances where outbreaks were spread through the country in the direction of the prevailing wind.

The period of incubation is not known. Following variolisation the first lesions appear in three or four days. In natural cases, however, pigs are doubtlessly infected by ingestion or inhalation, and thus the incubative period would be a good deal longer.

*Symptoms.*—Young pigs as a rule present grave general symptoms of depression, wasting, high fever, and sometimes diarrhoea. The vesico-pustular eruptions, which are more or less generalised on the skin, are evolved in 15 to 30 days and are rather haemorrhagic in character. The evolution of the skin lesions corresponds with that of human small-pox. Often, vesicles appear about the eyes and conjunctival mucous membrane, and may involve loss of the eyes. The lymphatic glands of the head and neck are very enlarged and softened. When the disease persists in a place, one often notices subcutaneous pustules about the size of hazel nuts containing creamy pus, and in

the region of the neck these sometimes may become as large as hens' eggs and involve the periosteum of the adjacent bones, later forming persistent fistulae.

The disease ordinarily lasts  $1\frac{1}{2}$  to 2 months in each centre of infection. There also exist septicaemic forms in which the disease runs a very rapid hyperacute course lasting only two or three days, and in which one only finds localisations about the head and mucous membranes, especially of the eyes. In fifteen to twenty days the whole of the young pigs in a place may be destroyed.

On post-mortem examination, one finds, in nearly all cases of the disease, a lobar pneumonia with abundant oedema.

When the disease breaks out it is impossible to predict the probable duration of the outbreak. After each case, the animals which have shown symptoms or have developed unnoticed pustules remain a source of infection. When the disease is localised it is always cured. When the eruptions become confluent and involve the mucous membrane the prognosis is very serious. It is always fatal in septicaemic forms. A certain number of infected animals show secondary symptoms, waste away, and die from lung complications. All animals which are seriously affected and recover remain for a long time "bad doers."

*Preventive Inoculation or "Variolisation."*—The authors find that the best material is obtained from vesicles three days after the commencement of symptoms. Before the second day no result is obtained, and later the products are purulent. The lymph is taken from a not too severe case of the disease. Conditions in the field are unfavourable for the preservation of the virus, hence the lymph pulp from the vesicles is inoculated immediately.

The seats chosen for inoculation are the inside of the thighs or the region of the folds of the groin. These are lightly scarified and the pulp applied. Three days after scarification the typical pustules of a benign variola appear and these always remain discrete and strictly localised. After recovery young pigs become immune.

(198) HARDE (Edna S.). **Some Observations on the Virus of Vaccinia.**

—*Ann. Inst. Pasteur.* 1916. July. Vol. 30. No. 7. pp. 299-306.

"*Summary.*—A pure active virus of vaccinia can be obtained by repeated partial disinfection with carbolic acid and glycerin.

"The virus of vaccinia incubated in tissue cultures composed of plasma and cornea or testis from normal rabbits or guinea-pigs shows a definite increase, but the degree of multiplication is not comparable to that observed in cultures of rapidly growing bacteria. The increase of the virus occurs mainly in the tissue, but very little in the surrounding plasma.

"The multiplication of the virus occurs without a corresponding development of vaccine bodies in the preparations.

"There is no growth of the virus in preparations containing cornea killed by freezing or by hypotonic salt solution.

"There is no evidence of the growth of the virus in preparations in which pieces of paraffin, heart, liver or kidney have been substituted for the cornea or testis.

"The virus is soon rendered inactive in preparations containing plasma and cornea obtained from an immune rabbit. The greatest lytic action is exerted by the plasma.

"Attempts at confirming Fornet's cultural experiments have been unsuccessful.

"Cultural experiments with other media and methods have also given negative results, although the virus has not been killed by incubation for eight weeks at 33° C."

## (b) RABIES.

(199) CARPANO (Matteo). **Su di un metodo rapido di colorazione dei corpi di Negri nella rabbia e sulla speciale struttura che si mette in evidenza col metodo stesso.** [A Rapid Method of Staining Negri Bodies and the Special Structure of these Bodies brought out by this Method.]—*Clinica Vet.* 1916. June 15–30. Vol. 39. Nos. 11–12. pp. 347–359. With 2 plates comprising 38 figs.

After reviewing the methods hitherto employed for staining Negri bodies, Carpano details the following technique.

Smears from the hippocampus are fixed either in absolute alcohol or, better, in Zenker solution. In the latter they are left for from four to five minutes, washed and again placed for a few minutes in iodised alcohol.

For the preparation of sections small pieces of hippocampus about  $\frac{1}{2}$  cm. in thickness are taken. To obtain the quickest results, they are fixed by placing them in acetone, which should be changed two or three times in the course of about two hours and kept at 37° C. The pieces are then clarified in xylol for 10 to 15 minutes and then placed in paraffin, fusible at 50° to 52° C., and kept at 55° C. for about an hour. Absolute alcohol can be used instead of acetone but fixation takes about double the time.

In order to study the histology of Negri bodies the best results are obtained by fixing in Zenker's fluid for four or five hours, then carefully washing in running water, and afterwards immersing for an hour in diluted iodised alcohol; the piece is then put in xylol at 37° C. for an hour, and then for two hours in paraffin wax fusible at 50° to 52° C., heated to 55° C.

STAINING.—The following solutions are employed :—

(1).—*Eosin.*

Eosin red (ethyl) or, better, eosin yellow ..	1 gramme.
Distilled Water .. .. .	100 cc.

(2).—*Crystal Violet.*

Crystal violet .. .. .	1 gramme.
Alcohol (95 per cent) .. .. .	20 cc.
Dissolve and add a solution of 2 per cent.	
phenol in distilled water .. .. .	500 cc.

(3).—*Iodine.*

Iodine .. .. .	1 gramme.
Potassium iodide .. .. .	2 grammes.
Distilled water .. .. .	400 cc.

The following are the directions for staining :—

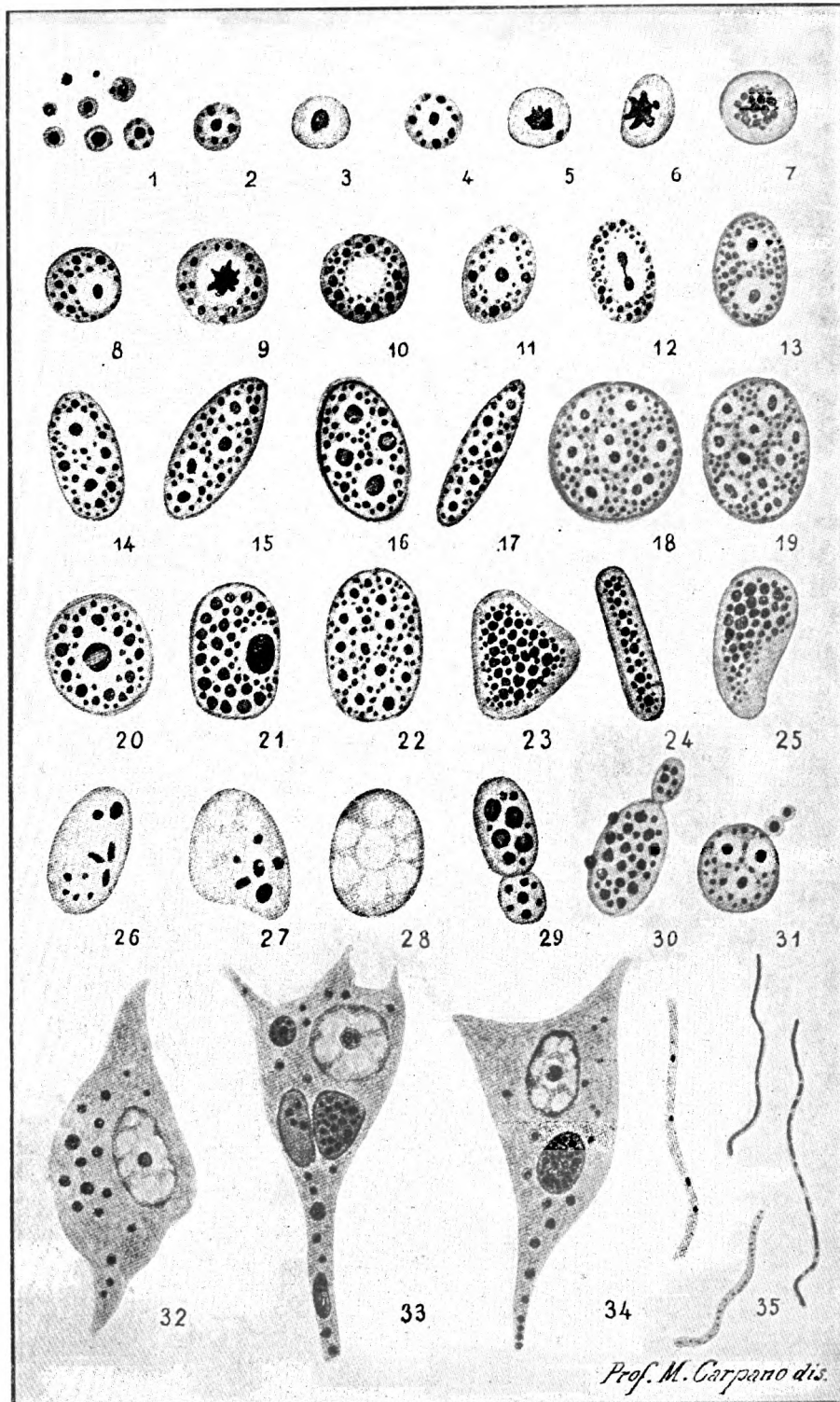
(1) About 10 drops of eosin (Solution 1) are placed on the smear or section for about one minute, run away, and without washing passed quickly into 95 per cent. alcohol.

(2) Before the slide is allowed to dry it is covered with about 10 drops of the crystal violet (Solution 2); the preparation is gently warmed until vapours begin to rise for about five minutes.

(3) The above stain is shaken away from the slide and without previous washing a few drops of the iodine (Solution 3) are put on and left for one minute.

(4) The last named fluid is then also shaken away and the preparation placed for a few seconds in 95 per cent. alcohol until the violet colour has almost completely disappeared.







(5) The preparation is passed quickly through absolute alcohol, clarified in xylol and mounted in Canada balsam.

By this method of staining the cellular elements appear more or less pale pink. The Negri bodies stand out distinctly as they stain of a very dark, decisive, violet colour. Under the low power of the microscope they look almost black, but under moderate and high magnifications they show distinct outlines and a granular interior which is not very clear on account of the intensity of staining.

Better internal differentiation, which is not necessary when staining for diagnosis, is obtained by substituting for the eosin solution a 1 per cent. solution of methylene blue. The specific bodies are then stained dark violet on a cellular basis which is pale blue.

The only elements which are stained in the same way as the Negri bodies are the nucleoli of the great pyramidal cells; these, however, are very easily distinguished on account of their not very distinct outline, constant size, and position in the interior, and often in the centre, of the cell nuclei.

The advantages claimed for this method of staining, besides its rapidity are (1) that it brings out the smallest forms of Negri bodies which are invisible by other methods, and (2) that it reveals their particular structure. One can see a progressive growth and follow a very probable evolution of the structures, and this tends to show that the bodies themselves are of a parasitic nature.

This growth and evolution can best be seen from the following reproduction of one of the Plates.

#### EXPLANATION OF PLATE.\*

1. Negri bodies in sections and smears of hippocampus of rabid dogs. Stained by the above method, drawn exactly as seen under the microscope and arranged according to probable development. Figs. 1 to 31 are magnified about 2,000 diameters; the remainder are magnified 800 times diameters.

Fig. 1. Initial forms and forms in the act of developing.

Figs. 2 and 4. Bodies in which granules derived from the primary nucleus are already abundant.

Figs. 3, 5 and 6. Elements in which the primary nucleus has remained undivided and acquired a different appearance.

Figs. 8 and 11. Forms in which the primary nucleus has become surrounded by an appreciable colourless halo.

Fig. 9. Element with central nucleus in form of star.

Figs. 7 and 10. Incomplete figs. as sections were not cut through centre of bodies.

Figs. 12 and 13. Forms in which the central nucleus appears in the act of dividing or else completely divided.

Figs. 14 to 22. Bodies in which rapid division of the nucleus has taken place; the greater part of the small nuclear masses are surrounded by clear halos.

Figs. 23 to 25. Elements in various forms containing large quantity of granules of various sizes.

Figs. 26 and 27. Bodies with a few nuclear granules irregularly distributed.

Fig. 28. Forms showing absence of nuclear masses and a distinctly vacuolated appearance.

Figs. 29 to 31. Bodies apparently undergoing gemmation. Fig. 30 shows at the same time the probable extrusion of nuclear granules.

Figs. 32 to 34. Large pyramidal cells containing Negri bodies in various forms and sizes; in the dendrites will be noticed more or less well-developed elements some of which are very small and arranged in beaded form.

Fig. 35. Filaments observed between the nerve cells, with contents showing various appearances.

\* Reproduced by permission of the Editor of *La Clinica Veterinaria*.

## (c) EQUINE INFECTIOUS ANAEMIA.

- (200) THEILER (A.) & KEHOE (D.). **Infectious or Pernicious Anaemia of Equines in South Africa.**—*Union of South Africa. Dept. of Agric. 3rd and 4th Reports of the Director of Veterinary Research.* 1915. Nov. Pretoria: Govt. Printing & Stationery Office, pp. 215-289.

Prior to the experiments described in this article by the authors, the above disease was not known to exist in South Africa. It was probably confounded with "biliary fever" (Nuttalliosis, or equine piroplasmosis), or horse sickness, especially in the form observed when an animal had passed through a previous attack and gained a relative amount of immunity, and probably also with the "ephemeral fever" described by THEILER.

The manner whereby the authors came to recognise the existence of infectious anaemia is described by them in the protocols of a number of exceedingly involved experiments. These experiments were originally carried out with a view to ascertaining the relative virulency of some newly collected strains of horse sickness, in order to find out which would be the most suitable in the immunisation of horses against horse sickness, and also to see which strain was the most virulent. This was done by intravenous inoculation into horses which had passed through one or more attacks of horse sickness (immune animals), and horses which had repeatedly received very large doses (10 litres of horse sickness blood intravenously) (hyper-immune horses).

Seventy-six hyper-immune, and four immune horses were available for these tests.

*Expt. 1 (10th Oct., 1913.)*—The above horses were divided into 10 lots and 10 newly collected strains of horse sickness were tested, by intravenous inoculation of 10 cc. of blood per horse, on respective lots. The results showed that five of these viruses did not cause reactions, while five viruses did; of these latter, three not only caused temperature reactions but even produced death from horse sickness in one case at least each, and one temperature reaction with "dikkop" each.

*Expt. 2 (27th Oct., 1913.)* (A) The viruses from the reacting horses of Expt. 1 were tested on horses of other reacting groups or lots, and where only a temperature reaction had been shown the virus was tested on a control animal in order to prove its capability of producing horse sickness.

Eight viruses (2nd generation) were thus tested.

It became noteworthy that four out of seven horses which had been inoculated in this manner with a certain virus (McCall 59) in Expt. 1 revealed, in the course of this second experiment, reactions which must be considered due to the first injection in Expt. 1. Temperature reactions which continued for 12 days or more were observed either before, or a day or two after, the second inoculation, (The mother virus, however, when tested on a susceptible animal produced death from horse sickness.) The daughter virus of this strain used in inoculating a group in this second experiment failed even to kill a control animal; it produced temperature reactions in the other animals and death in the case of one, which commenced reacting on the 17th day and died on the 31st, death being at the time attributed to broncho-pneumonia. The tardy reactions produced by this virus

(McCall 59) (used in Expt. 1) in the course of the second experiment the puzzled the authors on account of the clinical symptoms shown by horses, which did not resemble those of horse sickness or biliary fever.

(B) Eight additional new strains of virus were tested on the horses of those groups in Expt. 1 which had shown no reactions. It was found that three of these new viruses were capable of producing death from horse sickness in one animal in each of their respective groups, and in one animal of each group, of producing reactions accompanied by "dik-kop." The others either did not react or else produced reactions the nature of which was not understood at the time by the authors.

*Expt. 3 (13th Nov., 1913).*—The properties of three viruses from the first inoculation and three from the second inoculation, all obtained from horses which had died of horse sickness, and three viruses produced from the second inoculations which had given reactions of varying intensity, were tested in the same way on hyper-immune horses of other groups, using also control animals for the last three viruses.

*Expt. 4 (21st Nov., 1913).*—This was a test of the properties of the McCall virus produced from the second experiment.

The results of Expt. 3 and Expt. 4 showed that certain viruses other than the virus McCall were capable of producing a similar type of reaction and that in these new cases the incubation period might also be a long one (otherwise it would have to be considered too short). For example, the reaction which appeared on the first day after inoculation with a virus (Dunning) in the third experiment should be really considered due to the effects of virus (Onderstepoort) inoculated in Expt. 2, eighteen days previously; reaction which appeared on second day after inoculation in this experiment with virus (York) should be considered due to the virus (McCall 59, 2nd generation) inoculated in Expt. 2 nineteen days previously. Other similar reactions were produced which were unfamiliar to the authors and they concluded that some other disease was the factor in producing these results. Temperature reactions even appeared on the 37th day in controls from Expt. 2, and these animals did not die of horse sickness. When tested, however, later with known horse sickness strains they died of that disease.

Controls were inoculated with blood from eight of the horses that had shown reactions in Expts. 1, 2, and 3, and that had not yet been tested to see whether they were really capable of producing horse sickness. Six died of horse sickness, and of the remaining two, one died accidentally on the 18th day, having shown no reaction prior to death, and the other horse showed a temperature reaction from the 5th to the 8th days but did not die of horse sickness.

*Expt. 5.*—Here a study was made of the properties of three viruses, viz. :—

Dunning, 2nd generation, Martin, 2nd generation, Onderstepoort, 1st generation, by injecting them into horses of Expts. 1, 2 and 3 that had not previously received injections of the same viruses (18, 18 and 20 hyper-immune horses for each virus on 5:11:13, 6:11:13, and 17:11:13 respectively).

In considering the results of this experiment the authors state definitely that they were now dealing with pernicious anaemia. Nearly

all the horses inoculated with the first of these viruses succumbed to pernicious anaemia, some of those inoculated with the second virus died of the same disease, while most of those inoculated with the third virus also gave typical reactions. The date of death varied very considerably, the period intervening between the time of last injection varying from 26 to about 150 days, while a good many apparently recovered.

*Further experiments* were made in order to attempt to transmit the disease to animals of other species than the horse, to test the filterability of the virus, and to transmit the disease by administration of blood of affected animals by the mouth, and to transmit the disease by means of the urine of affected animals. The results of these experiments are given in the following remarks of the authors:—

“The general conclusions that therefore appear to be warranted from the results of the foregoing experiments are, that this disease appearing in horses is capable of being transmitted to other horses by the inoculation of the blood or serum of affected animals; that the virus present in the blood or serum of affected animals is capable under suitable conditions of passing through the pores of a Berkefeld filter; that the disease can be transmitted to the mule and the donkey; that we were unable to transmit it to cattle, sheep, goats, or dogs under the conditions of our experiments; and that it could be experimentally transmitted to horses by the administration through the mouth of blood or urine of affected animals when relatively large quantities of these fluids were used.

“The period of incubation of this disease following inoculation may be as short as five days, but, varying between this and twenty-five days, incubation periods of from ten to fifteen days are not uncommon, and in one instance the length of this period appeared to be thirty days. Further, the length of this period does not seem to be in any direct relationship to the type of disease which follows.

“A point of marked interest, however, to which we wish to draw attention is the relationship existing between this disease and horse-sickness, since it has been suggested by certain European workers that infectious or pernicious anaemia possibly represents a modified or mild form of horse-sickness, a suggestion which appears to have been based on an observation that a horse recovering from pernicious anaemia later proved refractory to infection by a particular strain of horse-sickness virus with which it was injected. The evidence on the point, however, was regarded as inconclusive, and, to our knowledge, no definite evidence for or against this view has since then been brought forward.

“Our experiments bear directly on this point, and furnish evidence to show that this view above referred to is incorrect, since the majority of horses in which the disease was produced in these experiments were horses not only immune to different virulent strains of horse-sickness virus, but animals which had even been hyperimmunized, to the extent of 10 litres given intrajugularly, with the virulent blood of horses, passing through horse-sickness reactions induced by the injection of markedly virulent strains of horse-sickness virus.

“We, therefore, from our experiments cannot support the view that infectious or pernicious anaemia represents a modified mild form of horse-sickness, but are forced to regard the two diseases as entities separate and distinct in themselves.

“Another point which the consideration of our experimental observations bring us to remark upon, and which may be noted here, is the apparent unsuitability of the terms infectious or pernicious “anaemia” as descriptive appellations of the disease, for although the disease is definitely infectious, and anaemia is apparent in the chronic form, still anaemia is not necessarily a well-marked clinical symptom in animals suffering from the more acute form of the disease or in those animals which, though clinically recovered, may yet remain virus “carriers” or “reservoirs.”

“This latter observation in regard to the absence of anaemia in acute cases is one to which reference has also been made by other investigators,

but we have here retained the names of infectious or pernicious anaemia to denote the disease as being names by which it is already widely known, and under which it is most commonly referred to in the literature dealing with the subject."

A discussion of the symptoms presented in infectious anaemia of equines is given, the acute, sub-acute, and chronic forms being separately treated. This description would apparently apply to the experimental cases observed by the authors as no record of naturally infected cases is given.

Instances are described where the blood of animals apparently clinically recovered remained infective for a long period.

Drugs such as formalin, iodine, and arsenical preparations exerted no curative effects.

A careful description of the post-mortem appearances of animals which had died from the disease in various degrees of severity is given. No characteristic lesion is, however, discoverable.

The authors devote a considerable amount of work to a study of the appearance of the bone marrow, as European authors and the Japanese Commission had insisted that considerable changes took place in this tissue. The bone marrow from the femur and humerus of 201 animals which had suffered from a variety of diseases were carefully examined. The results showed "that the appearances met with in the bone marrow of animals dying from pernicious anaemia may also be met with in animals coming to post-mortem as a result of various other conditions, and therefore cannot be regarded as especially characteristic lesions of the former disease."

Twelve pages are next devoted to the literature dealing with the disease.

*Problem introduced by the disease into the production of horse sickness anti-serum, and methods used for diagnosis of the disease.*

In naturally infected cases, the other two diseases which commonly affect equines in South Africa, viz., horse sickness, and biliary fever, can be distinguished from infectious anaemia without any great difficulty. Under experimental conditions following the injection of horses, already immune, with horse sickness virus one meets with cases where febrile reactions are encountered which at first present a little difficulty in diagnosis. The further progress of the cases and the presence or absence of repeated febrile attacks and other symptoms of sub-acute or chronic forms of infectious anaemia serve to distinguish the diseases. Ephemeral fever is similarly distinguished.

In the manufacture of horse sickness anti-serum the following precautions are now observed. The temperature of the "virus" horse is taken regularly morning and evening for from four to six weeks or longer before its blood is employed for injecting a "serum" horse. The "serum" horse is also kept under temperature observations the whole time it is used in serum production and even for six or seven weeks following the last hyper-immunisation. The serum obtained from individual "serum" horses is kept in separate vessels for several months before mixing. Should a "serum" horse show a temperature reaction at any time following hyper-immunisation, the blood or serum previously obtained from it is injected into a susceptible horse, and if the disease then appears in the latter animal the serum obtained from the former is rejected and

destroyed. If a number of "serum" horses show suspicious reactions a collective test is first made by injecting a mixture of the suspected sera into a susceptible horse, and if the result of this test should prove to be negative no further test is performed; if, however, it proves to be positive then further tests are carried out in order to isolate the individual infective sera or serum.

The cost in serum production is thus considerably increased, for whereas previously 67 per cent. of hyper-immunised horses became available for bleeding, now the percentage is further reduced owing to the rejection of animals infected with infectious anaemia.

(201) CARRÉ & VALLÉE. *Sur l'étiologie de l'anémie infectieuse du Cheval.*—[The Etiology of Equine Infectious Anaemia.]—*Rec. de Méd. Vét.* 1916. Apr. 15. Vol. 92. No. 7. pp. 193-199.

In this note the results of work undertaken in the course of the last 12 years by the authors are summarised, and reference is made to the work of distinguished observers who have since confirmed the authors' original findings incriminating an ultra-visible virus as the causal organism of the disease.

\*SEYDERHELM (K. R.) and SEYDERHELM (R.), and also RIES have recently, however, ascribed the cause of infectious anaemia to a poison (*oestrine*) contained in the bots of the horse (*Gastrophilus equi* and principally *Gastrophilus haemorrhoidalis*). They arrived at this conclusion because, when aqueous extracts of these larvae are injected into the horse, there are produced either acute fatal accidents or else a progressive chronic disease accompanied by anaemia and fever.

Carré and Vallée were unable to demonstrate this property in bots collected by them, and the Japanese Commission, which undertook the study of the disease, was no more fortunate. They further refuse to admit the unicity of pernicious anaemia of the horse, and that the disease is only verminous in origin.

The following are the main points which they bring forward to prove that there exists in the equine species an infectious anaemia of an inoculable bacterial nature due to a filterable virus.

(1) Nearly all the horses affected with anaemia kept by the authors for their experiments did not contain bots or verminous aneurisms. Whilst the geographical distribution of infectious anaemia is limited, bots and strongyles can be found in abundance in innumerable healthy horses and in places where infectious anaemia has never been known to exist.

(2) The "poison" of bots discovered by K. R. and R. SEYDERHELM is resistant to heating in the autoclave for one and a half to three hours and is unaffected by alcohol, acetone, ether, chloroform and iodine trichloride. The virus of infectious anaemia is destroyed by heating to 60° C., and this has been confirmed by OSTERTAG, MAREK, the Japanese Commission, etc.

(3) In their experiments the authors were able to realise five successive "passages" of the infection from horse to horse. It has

\* [K. R. & R. SEYDERHELM. Die Ursache der perniziösen Anämie der Pferde (*Archiv. für exper. Pathologie u. Pharmakologie.* 1914. Vol. 76. p. 149-201).]



never been demonstrated to their knowledge that an intoxication of verminous origin can thus be transmitted in series. K. R. and R. SEYDERHELM, however, maintain that "oestrine releases without doubt an ultra-visible organism which remains inactive in the horse's body until this poison gives it power of propagating, and virulence." They are thus brought round in a tortuous manner to admit the intimate virulent nature of infectious anaemia. (The role of insects in the transmission of the disease has not yet been worked out.)

(d) SWINE FEVER.

(202) KING (W. E.) & DRAKE (R. H.). **The Antigenic Value of Spirochaeta Hyos in Complement-Fixation Tests on Hog-Cholera Sera. Studies on Hog-Cholera.**—*Jl. Infect. Dis.* 1916. July. Vol. 19. No. 1. pp. 46-62. With 5 charts.

The antigen employed in these tests consisted of an alcoholic extract of *Spirochaeta Hyos*, obtained from pure cultures of the organism. The latter is stated to be present in the intestinal ulcers, caecal crypts, and external local lesions of animals suffering from hog-cholera and has been previously described by the authors in a number of publications.

The authors insist on a careful titration of the materials used for the test. With this antigen, the authors have performed a series of 115 complement fixation tests. Of these, 22 were with normal hog sera from ten different animals, one was with serum from an animal which exhibited a reaction only following inoculation with virus, six with sera from two convalescent or naturally immune swine, 84 with sera from 24 animals suffering from hog-cholera, and one test each was made with two different lots of hyper-immune serum. The animals suffering from hog-cholera had been infected with virus from five different strains obtained from different parts of the United States.

The results, which are recorded in tabular form, show that haemolysis (—) occurred in all cases in which normal hog sera were used whilst complement fixation (+) resulted in all tests with sera from cholera hogs, except in two cases.

Further experiments showed that complement fixation commenced to appear at about the same time as the clinical symptoms, and that the time of its appearance depended on the virulence of the infective material and the individual resistance of the animal.

Another experiment indicated that the complement-binding substances ceased to exist in the blood when immunity against hog cholera became fully established.

The authors undertook control tests with the following antigens:—(1) *B. cholera-suis* (received from Theobald SMITH), (2) *B. voldagsen* (received from HAENDEL), (3) *B. typhi-suis* (GLAESSER). (4) *Sp. hyos* antigen. Entirely negative results were observed when the first three antigens were used whereas pure *Sp. hyos* antigen gave positive results.

In order to test the specificity of the *Sp. hyos* antigen the authors procured sera from pigs which they had infected experimentally with the following diseases:—(1) *Staphylococcus* septicaemia, (2) *B. cholera-suis* infection, (3) Anthrax, (4) *Ghon-Sachs* bacillus infection, (5) Brine or salt poisoning and pneumonia. The antigen possessed no complement binding properties when brought into contact with the above sera.

- (203) DORSET (M.) & HENLEY (R. R.). **Production of Clear and Sterilised Anti-Hog-Cholera Serum.** (Preliminary paper.)—*Jl. of Agric. Res.* 1916. May 29. Vol. 6. No. 9. pp. 333–338. With 2 tables.

In the United States the anti-hog-cholera serum of commerce for the most part consists of defibrinated blood of hyper-immunised pigs, this practice being adopted owing to the difficulty experienced in separating the serum from the fibrin and the blood corpuscles.

When allowed to undergo spontaneous coagulation one finds in practice that not more than 30 to 35 per cent. of serum can be secured from the blood, the remainder of the serum being held firmly within the large clot.

Owing to the occurrence of foot-and-mouth disease in the United States and the accidental infection of certain lots of anti-hog-cholera serum and virus with this disease, it was found necessary to adopt some method of treating these products which would serve to remove the possibility of either of them being a medium for its dissemination. There would seem to be only one means by which the serum might be sterilised in so far as the virus of foot-and-mouth disease is concerned, and that is by the application of heat. Heating to a temperature of 50° C. for 12 hours kills this virus, and it has been shown that defibrinated hog-cholera-immune blood may be so heated without destroying the anti-bodies or altering the physical character of the defibrinated blood. In practice this process is difficult and expensive to carry out.

When defibrinated hogs' blood is subjected to centrifugalisation (force equivalent to 1,700 times gravity for 20 to 30 minutes), a yield of about 50 per cent. of serum is ordinarily secured. The serum thus obtained is usually cloudy, and owing to the fact that the red blood corpuscles are not firmly packed together it is impossible to remove all the serum without at the same time carrying over some of the red cells.

In order to overcome the above difficulties the authors have used an extract of the seed of different varieties of the common garden bean (*Phaseolus multiflorus* and *P. vulgaris*). Extracts of these beans are known to possess the property of agglutinating the red blood corpuscles of the pig's blood and they are said to be non-toxic. Very minute amounts of the extract of these beans serve to agglutinate large quantities of the defibrinated blood, and when such agglutinated blood is centrifugalised the red cells are packed together forming a rather stiff jelly-like mass and a yield of 50 per cent. of serum may be separated. The serum thus obtained is clear and may be readily poured from the tube.

In order to secure a greater yield of serum and a more firmly packed clot of red corpuscles, the authors further recommend the addition of 1 per cent. of sodium chloride to the defibrinated hog's blood after agglutination caused by the addition of bean extract has begun. This will increase the yield of serum from 50 per cent. without salt to 70 per cent. when salt is added.

The authors recommend the following technique for the preparation of clear sterile serum heated to avoid the possibility of foot-and-mouth disease infection.

*Preparation of bean extract.*—100 grammes of coarsely ground white navy beans are allowed to soak for one hour in 500 cc. of distilled water with occasional stirring; the mixture is then strained, and filtered through a bacteria-proof filter.

*Preparation of defibrinated blood for centrifugalising.*—1 cc. of sterile bean extract is added to each 100 cc. of the cool defibrinated blood, stirred, and then allowed to stand until agglutination commences, which is usually apparent within five minutes of adding the extract. One gramme of finely powdered sodium chloride is then added, stirred in until dissolved, and the mixture is then allowed to stand for about 15 minutes.

*Centrifugalising.*—The defibrinated blood mixture is centrifuged for 15 minutes at a speed sufficient to produce in the cups a precipitating force equal to approximately 1,700 times gravity. The serum is then poured from the cups into suitable containers.

*Heating the serum.*—The vessel containing the clear serum is placed in a suitable water bath maintained at a constant temperature of 60° C. for 30 minutes. The serum is then rapidly cooled and one part of a 5 per cent. solution of phenol is added to every nine parts of serum.

*Filtering the serum.*—After the addition of phenol a slight precipitate sometimes forms in the serum, and it is thus desirable to allow several days to elapse between the addition of phenol and the final filtration through a bacteria-proof filter of infusorial earth.

An experiment in which ten pigs were used demonstrated that the amount of anti-bodies left behind with the red blood corpuscles was negligible, as the latter, when injected subcutaneously even in large quantities, failed to produce any immunity against the hog-cholera virus. Also, there was hardly any difference between the degree of immunity conveyed by the serum alone, and the defibrinated blood. This showed that the serum may be heated for half an hour at 60° C. so as to safeguard against infection with foot-and-mouth disease without any noticeable impairment of its potency.

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#### DIETETIC DISEASES, Etc.

(204) GRAHAM (R.) & HIMMELBERGER (L. R.). **Studies in Forage Poisoning. III.**—*Jl. Comp. Path. & Therap.* 1916. June. Vol. 29. Pt. 2. pp. 107-116.

This article is a continuation of the authors' studies on forage poisoning.

Considerable losses were caused among cattle and horses in Kentucky fed during the winter months on silage. Bacteriological examination of this (N.) silage revealed the presence of a micro-organism similar to that previously isolated by the authors from an oat hay, which was shown to possess pathogenic properties.

This micro-organism occurred in the form of a short bacillus 1 to 2 microns long by 0.4 to 0.5 microns broad, motile, spore-producing, staining with the ordinary anilin dyes, Gram-negative, and aerobic. Grows well on agar.

The authors describe 14 experiments on cattle, horses, sheep, goats, and small laboratory animals. In these experiments feeding and inoculation tests were carried out with silage, watery extract of silage, cultures of the bacillus, and sterile filtrates from cultures. The results of these experiments are included in the following conclusions :—

“A bacillus isolated from N silage possessed pathogenic properties towards some experimental animals. We were unable to demonstrate its fatal character for all of our experimental animals. Calves No. 5 and No. 7 furnish evidence of its pathogenicity. The remaining calves and two mature cows are suggestive of the transitory effects exercised by this organism, while horses seemed most susceptible and guinea-pigs and rabbits were apparently immune. We are not in a position to say that similar results could not be attained with other bacteria isolated from apparently poisonous forage or even with bacteria isolated from wholesome forage.

“Daily administrations of sterile filtrates of this bacillus grown on a synthetic medium, introduced intrajugularly, and bouillon cultures in the form of enemas, produced death in horses, as did also daily drenches of bouillon cultures to calves, with clinical manifestations and gross anatomical changes not unlike those observed in some cases of forage poisoning.

“The morphological and cultural features of this bacillus are in every major detail analogous to those possessed by a pathogenic organism isolated from an oat hay responsible for losses among horses and mules, as demonstrated by feeding experiments. The possibility of this bacillus being closely related to the spore-bearing bacillus from a different source, described in a previous publication, is further suggested in experiments on horses by the manifestation of similar symptoms and *post-mortem* lesions after death. A poisonous substance is evidently produced by the bacillus in question, since sterile filtrates of cultures grown on Uschinsky's medium produced death in horse No. 62, as well as other experimental horses not recorded in this paper. The symptoms following intravenous injections are quite sudden and intense, yet not unlike those observed subsequent to intestinal or rectal absorption in calves and horses. In a control experimental horse no unfavourable results followed the daily intravenous injection of similar quantities of sterile uninoculated Uschinsky's medium or daily enemas of sterile bouillon. It is at least a suggestive contribution to our knowledge of forage poisoning that a bacillus may be associated with silage which on being cultivated on synthetic media is found to produce a substance poisonous to horses. The poisonous properties of this bacillus may be extra-cellular, or endo-cellular as a result of cell disintegration. The toxic properties of this bacillus could not be demonstrated by single injections into guinea-pigs and rabbits, using sterile cultural filtrates grown on Uschinsky's medium that proved to be pathogenic to horses. The method used to demonstrate anaphylactic phenomena in guinea-pigs with other foreign protein (egg white) failed. In this connection some anaphylactogens (bacterial) sensitise in very minute doses, while larger and repeated doses are necessary in other cases.

“Difficulty has been reported in sensitising guinea-pigs to bacterial protein. According to Rosenau and Anderson, Vaughan, Holobut, and Kraus and Doerr, a variation of technique in sensitising guinea-pigs seems more reliable than the usual methods employed in sensitising to animal proteins. The limits seem to vary with the protein and the animal. If true anaphylaxis occurred in horses Nos. 48 and 55, it is in further variation of the usual technique employed to demonstrate this phenomenon, as there existed no intervening or rest period subsequent to feeding or sensitising and the injection of the toxic dose.

“Further evidence that the filtrate immediately after filtration does not contain true protein substances are the negative chemical tests with Millon's fluid, xanthoproteic, and Heller's ring test. The uninoculated sterile Uschinsky's protein-free medium gives a positive reaction for protein by the biuret test, as does the sterile filtrate of this bacillus in Uschinsky's medium, but the latter test is not considered reliable for detecting the presence of true protein. Horses gave evidence of hypersensitiveness when injected with N-1 culture filtrate on synthetic medium

subsequent to being fed with the N silage and watery extract of same to drink, and also subsequent to the feeding of O-1 cultures on bouillon, yet death followed daily injections of the sterile filtrate without preliminary treatment, suggesting the poisonous properties of the filtrate *per se*.

"Following the initial injection, manifest disturbances generally occurred in a few minutes. The sudden manifestations following injection preclude the possibility of a true soluble toxin or bacterial infection, but clearly suggest the presence of a substance which exerts a toxin-like effect. The cumulative or hypersensitive-like condition prevailing in horse No. 55 is evidence of the close relationship existing between the filtrate obtained from the bacillus isolated from the silage and the filtrate from the bacillus isolated from the oat hay, feeds responsible for widely separate outbreaks of this disease."

(205) STOCKMAN (S.). **Cases of Poisoning in Cattle by Feeding on Meal from Soya Bean after Extraction of the Oil.**—*Jl. Comp. Path. & Therap.* 1916. June. Vol. 29. Part 2. pp. 95-107.

This article is of interest on account of the very widespread use at present of soya bean products as feeding stuffs for cattle in all parts of the world, and on account of the often alleged cases of poisoning resulting from their use. The experiments described in this article were undertaken to ascertain the cause of deaths amongst a number of cows in the south of Scotland which had been fed on soya bean meal.

The symptoms, which were sudden in their onset, were as follows: Discharge of blood from the nostrils, congestion of the visible mucous membranes, suspension of rumination, shivering, high fever (105° to 109° F), discolouration of the faeces due to blood; symptoms of abdominal pain; presence of subcutaneous nodules, from the size of an egg to that of a child's head, caused by haemorrhages. The interval elapsing between the first appearance of symptoms and death in the case of the 36 animals observed varied from 1 to 17 days.

On post-mortem examination widespread haemorrhages were found on all the mucous and serous membranes of the body. In the small and large intestines these haemorrhages had caused the rupture of the mucous membrane, and appeared like the haemorrhagic ulcers sometimes seen in cattle plague and East Coast fever.

Fourteen experiments were carried out by the author with samples of the extracted soya bean cake and meal on 8 heifers, 2 pigs, 1 ewe, 3 guinea-pigs, and a rabbit. The author summarises his experiences as follows:—

"1. The cases produced at the laboratory by feeding on extracted soya cake and meal are identical in symptoms and *post-mortem* lesions with the cases occurring in the field amongst cattle which were fed on similar material.

"2. In both cases the animals were receiving other food-stuffs (some went out to grass). This discredits the possibility of the trouble being due to a deficiency in vital constituents, as in the scurvy type of disease.

"3. In both cases the trouble sometimes did not show itself for one or two weeks after the extracted soya meal or cake had been discontinued and the animal had been turned out to grass. This is a curious feature, and points to the poison being one which takes some time to act, although a poisonous dose is present in the system. It might also mean that the actual poison is manufactured inside the animal by a slow process from extracted soya (*see also* 4).

"4. The extracted soya in no case (practice or laboratory) produced a sudden effect; in all a considerable amount was consumed, and a considerable time elapsed before signs of illness appeared. The smallest

amount consumed at the laboratory before disease began was 172 lbs. (thirty-six days); the shortest time in which disease appeared was twenty-nine days (201 lbs.).

" 5. No species other than cattle suffered from feeding on this meal or cake, either in practice or at the laboratory.

" 6. The very high temperature (106° to 109° F.) accompanying the illness seems to exclude the ordinary poisons, but does not exclude a poison of the ricin class. Specific bacterial infection was excluded by test inoculations, microscopical and bacteriological examinations, and by the fact that a sterilising temperature was used in the process of manufacture. No castor seeds could be traced in the meal.

" 7. From inquiry (very wide) whole soya bean is not poisonous.

" 8. From inquiry amongst manufacturers there is plenty of evidence that soya extracted with naphtha does not cause poisoning, and it would appear that trouble followed the use only of soya extracted with trichlorethylene.

" 9. Trichlorethylene itself, however, is not poisonous when given to cattle in comparatively large doses—1 to 3 ozs., and for long periods. It may be: (a) that the products from trichlorethylene obtained by heat are poisonous (this is doubtful); (b) that the trichlorethylene in contact with the soya and heat used to drive off the former forms a poison; or (c) that some of the trichlorethylene was impure and contained other bodies.

" 10. It would appear from what occurred in practice that all bovines are, at least, not badly affected by the poison. On nine premises upon which trouble occurred the percentage of visibly affected varied from 1 to 19 per cent.—average, 10 per cent. The farmers thought, however, that the other animals suffered also, though not visibly. It is not improbable, of course, that this was so (*see also* Experiment III), and that it was only the very badly affected which were taken as being ill. Amongst the visibly affected the death-rate varied from 6 to 100 per cent.—average, 84 per cent. It is possible, having regard to the above, that the poison is one against which a certain amount of immunity can be acquired, as in the case of ricin, but such an immunity did not show itself in Heifer 313.

" 11. If it be that, in order to obtain a poisonous quantity of the active agent, some 200 lbs., or more, of the material must be extracted, it would hardly seem to be a process which could be undertaken in an ordinary laboratory, but would require a small manufacturing plant.

" 12. If it be that the active agent is elaborated from the extracted soya in the digestive organs of bovines the problem of isolation becomes still more difficult.

" 13. If 12 be assumed, the most promising method of search might be to produce cases experimentally, and then try to extract a poison from the organs.

" 14. Extracted soya meal constitutes an excellent auxiliary foodstuff for cattle, but it is inadvisable to use trichlorethylene as the extractor."

(206) THEILER (A.), GREEN (H. H.) & VILJOEN (P. R.). **Contribution to the Study of Deficiency Disease, with Special Reference to the Lamziekte Problem in South Africa.**—*Union of South Africa. Dept. of Agric., 3rd & 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 9-68. Pretoria: Govt. Printing & Stationery Office.

The scheme of work considered in this communication comprises:—

" (a) Rice-feeding experiments upon cattle, horses, sheep, goats, and pigs, with the object of producing, if possible, deficiency disease in the animals concerned, and of comparing the symptomatology of such disease with gal-lamziekte.

" (b) Experiments with pigeons with the primary object of testing various rations used in the other experiments, in respect to their anti-neuritic efficiency or vitamine content.

“(c) Experiments on dogs with the object of inducing an avitaminosis by rice-feeding, and of testing the effect of feeding flesh of cattle which had died from lamziekte.

“(d) Feeding experiments upon cattle running on the lamziekte camps at the experimental farm, Armoedsvlakte, near Vryburg, Bechuanaland.

“In this case the object was to determine whether or not lamziekte, in its natural incidence, could be (1) controlled prophylactically by the use of supplementary rations of known high vitamine content, (2) successfully treated with vitamine extracts, (3) increased by partially substituting polished rice, known to be deficient in vitamins, for the natural pasturage, (4) influenced by factors which affected the condition of the cattle without seriously affecting the vitamine content of their diet or the extent of natural grazing.

“(e) Feeding experiments with hay cut at random from lamziekte camps, with the object of eliminating as far as possible all factors other than the purely dietetic.

“(f) An attempt to co-relate the incidence of disease with the rainfall and condition of the veld on the area concerned, in respect to hypothetical vitamine deficiency of the natural pasturage.”

The results of an enormous amount of work are described which throw a good deal of light on the “vitamine” problem. The authors failed to connect the causal agent of lamziekte with any “vitamine” deficiency in the feeding stuffs. A careful perusal of this article would be of great interest to students of physiology and dietetics.

#### Summary and Conclusions.

“The primary economic purpose of the investigations detailed in the text was to obtain evidence for or against the hypothesis that the South African disease known as lamziekte or gal-lamziekte, a neuro-muscular fatal complaint of cattle, is an avitaminosis. Correlated to this was an attempt to produce an avitaminosis in various classes of animals and to obtain data of general interest in scientific dietetics. The evidence incidentally acquired suggesting other theories of causation, is not specifically considered.

“Pigeon-feeding tests were carried out to determine the anti-neuritic properties of various foodstuffs, more particularly those fed as supplementary rations to cattle naturally grazing over lamziekte veld suspected of vitamine-deficiency.

“On the basis of these tests, different batches of cattle on the affected area were supplied with vitamine in the form of beans, bran, maize, potatoes, and yeast, in amount in large excess of the theoretical quantity required for the metabolism of the gross food eaten. At the same time another batch was supplied with a liberal ration of polished rice with the idea of still further reducing the vitamine-content of the natural diet. The mortality in the batches receiving supplementary vitamine-rich rations and in the batch receiving polished rice, was the same as that of the control animals, and the conclusion was therefore drawn that the prevalence of lamziekte bears no relation to the vitamine-content of the natural pasturage.

“Kraaled cattle fed on hay cut at random from lamziekte areas did not contract the disease, and in so far as the limited nature of the experiment allows of a conclusion, the disease would appear to be non-dietetic (*in the nutritional sense*) in origin.

“No clear relation of rainfall to prevalence of the disease on the experimental area could be detected.

“No clear difference in mortality could be detected amongst cattle in good condition and those in poor condition. An average mortality of about 30 per cent. in the experimental cattle prevailed independently of feeding or condition.

“Therapeutic treatment with vitamine extracts, even in theoretically excessive amounts, and prophylactic treatment with yeast, proved useless.

"Cattle fed for periods up to thirteen lunar months on synthetic rations of exceedingly low vitamine-content, as judged by accepted criteria and pigeon analysis, failed to develop either lamziekte or any specific disease which could be diagnosed as an avitaminosis. This is regarded as strong corroborative evidence against the vitamine-hunger theory as applied to lamziekte, and the view is incidentally expressed that an avitaminosis in cattle is not likely to occur in practice unless manifested simply in an atrophic form clinically indistinguishable from inanition.

"Horses, fed upon diets similar to the polished rice rations fed to cattle, also developed no symptoms of specific deficiency disease within periods of six months, and the conclusion is drawn that an avitaminosis in the horse, if it exists at all, is a matter of slow development, and would tend rather to be obscured by preceding inanition, on any naturally occurring diet upon which the animal could conceivably be fed.

"Dogs fed on polished rice succumbed, after periods varying up to four months, under symptoms suggestive of generalized malnutrition rather than those of a specific clinically recognizable avitaminosis of either the beriberi or scurvy type. Specific rather than general deficiency is, however, regarded as the cause of death, although the calorific intake was not sufficiently accurately ascertainable to settle the point.

"Lamziekte biltong showed it was probably as efficient as ordinary biltong in enabling dogs to maintain equilibrium on a polished rice diet, and in restoring dogs, emaciated after rice feeding, to normal health. These experiments are regarded as analogous to pigeon tests in which no marked constant difference in vitamine content could be detected between dried flesh from healthy animals and that from diseased animals. The dogs showed no ill-effects as a result of eating the diseased biltong.

"Pigs, goats, and sheep, fed for prolonged periods on rations in which polished rice was either the exclusive or the preponderating constituent did not develop any specific deficiency disease. No definite conclusion, however, is drawn from these experiments, since the protocols are open to interpretation in more than one way.

"A number of points in connection with the problems of growth and general dietetics are raised."

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#### THERAPEUTICS.

- (207) GREEN (H. H.). *The Sulphur Sheep Dips.—Union of South Africa. Dept of Agric., 3rd & 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 113-162. With 3 plates comprising 13 figs. Pretoria: Govt. Printing & Stationery Office.

In this article the chemical aspect of the sulphide dips are dealt with in the following order:—

- (1) Caustic soda and sulphur dip.
- (2) Lime and sulphur dip.
- (3) Loogas and sulphur dip.
- (4) Efficacy for the cure of scab.
- (5) Probable decomposition of the sulphide dips in the fleeces of the sheep.
- (6) Effect upon the skin and wool of sheep.

The following is the author's summary:—

"1. The caustic soda and sulphur dip, as prepared according to the recommendations of the Division of Sheep, consists of a mixture of sodium pentasulphide and sodium thiosulphate with a distribution of sulphur



about four-fifths of the former and one-fifth of the latter. No monosulphide can be detected and only traces of sulphate are present. There is even the suggestion that polysulphides higher than the pentasulphide exist for a short time in the freshly prepared dip. The proportions of caustic soda and sulphur actually going into combination are approximately five to eight, and the recommended formula, 5 : 20 : 2½-100, provides so large an excess of free sulphur that complete utilization of caustic soda is ensured even under somewhat careless conditions of dip-making. The presence of free caustic soda in the dip need not therefore be feared if the instructions for dip-making are carefully carried out. The preliminary mixing of the sulphur to an homogenous cream with water is the most important step to be observed, since it is upon the intimacy of subsequent contact of the sulphur with the caustic soda solution that the reaction mainly depends. Combination takes place at comparatively low temperature, and may be completed in forty minutes at 50° C., although reaction is of course more rapid at higher temperatures. If hot water is used in the preliminary mixing, the heat evolved as the caustic soda is sprinkled in suffices to keep the mixture near the boiling point, and boiling by the application of external heat is therefore unnecessary. Boiling, however, may offer slight advantages in completing the reaction in cases where the preliminary process has been imperfectly carried out. With ordinary care a dip of correct composition always results, without boiling. If the sulphur is not properly wetted in the preliminary mixing to a cream, the bulk of the sulphur may float on the surface and cake as the caustic soda is sprinkled in, and so partially escape combination. The dip may then contain residual free alkali, but not, as might be expected, any appreciable amount of sodium monosulphide.

“ 2. The lime-sulphur dip is analogous in composition to that of the caustic soda and sulphur dip, and consists of a mixture of calcium pentasulphide with calcium thiosulphate. In preparing the dip the ingredients must be boiled, and the so-called ‘raw lime-sulphur dip’ consists merely of a mixture of lime and sulphur. At least two parts of sulphur to one part of unslaked lime should be used whenever a really good sample of lime is available. If other proportions are used, the material present in smaller amount determines the solution of the other, higher polysulphide rather than lower being formed in all cases. If the lime is in excess, small quantities of free hydroxide may be present in the dip, but the amount is limited by the low solubility of the lime itself. Calcium pentasulphide and calcium hydroxide can, however, co-exist in the same solution even at the boiling point.

“ 3. The loogas-sulphur dip consists mainly of a mixture of carbonates, polysulphides, and thiosulphates, of sodium and potassium, the amount of polysulphide being very low and the amount of carbonate relatively high. The reaction between alkaline carbonates and free sulphur is very imperfect even after prolonged boiling, and most of the sulphur used in making the loogas dip is therefore wasted by passing into the unused sediment.

“ 4. The kind of sulphur used in dip-making is of no consequence provided it is finely divided and fairly pure. Flowers of sulphur and ground rock sulphur are equally suitable, but in the latter case a guarantee of fineness of grinding should be demanded. 65° Chancel is suggested as a reasonable specification.

“ 5. The quality of lime used is obviously of paramount importance in making the lime-sulphur dip, but limes generally available in the Union appear to be of very inferior grade. The saving grace in cases where bad limes have been used in practice, lies in the fact that concentrations of poly-sulphide much below that obtained in a well-made dip are still effective in curing scab.

“ 6. The lime-sulphur and caustic soda and sulphur dips are reliable for the cure of scab. The loogas-sulphur dip also cured scab in the experimental trial carried out, but its composition suggests that its efficacy is largely a matter of chance, and that it is therefore not to be relied upon.

“ 7. The active constituent of the sulphur dips appears to be the polysulphide, since thiosulphate, the only other important constituent is itself

ineffective. Free base, if accidentally present, does not contribute to the parasiticidal efficacy of the dips. A concentration of 0.6 per cent. sulphur in polysulphide form is probably always high enough to effect a cure. 0.3 per cent. showed itself as uncertain in action. The polysulphide content of the home-made lime-sulphur dip is much higher than that of the caustic soda and sulphur dip, but it is not advisable to dilute the home-made dip further than is already customary unless the lime used in making is known to be of very high quality. If commercial lime-sulphur concentrates are used, dilution may be conveniently carried down to a concentration of about 0.8 per cent. polysulphide sulphur.

"8. The sulphur dips if properly made (almost neutral to phenolphthalein) are harmless both to the sheep and to the wool. Solutions of polysulphide, at the concentration used in dipping, have no action on wool even on prolonged steeping. On the fleeces of dipped sheep polysulphide is rapidly and almost quantitatively converted into thiosulphate by atmospheric oxidation, and this occurs long before the fleeces are dry. No depilatory substances are formed in detectable amount, as intermediate products in normal decomposition. If, however, free base be present in large quantity along with polysulphide it is possible for monosulphide to be formed as intermediate product in the course of atmospheric oxidation, and the possibility of depilatory action then arises. Minor quantities of free hydroxide, up to about 10 per cent. of the total base present in the dip, appear to be of no practical consequence, since they are converted into thiosulphate during atmospheric oxidation. The depilatory action of monosulphide or hydrosulphide is much more violent than that of free hydroxide.

"Under ordinary circumstances a dip would have to be very badly made indeed before the amount of residual base present could become a source of danger in practical dipping, and if reasonable care is taken in preparation the possibility of injurious action either upon the sheep themselves, or upon their wool, is altogether ruled out.

"Although dyeing or spinning tests could not be carried out at this laboratory, it appears highly improbable that the expert dealer in woollen fabrics could tell the difference between a washed fleece previously dipped in the sulphur dips and a washed fleece previously dipped in any of the ordinary proprietary dips."

(208) GREEN (H. H.). **Upon the Composition and Analysis of Polysulphide Solutions.**—*Union of South Africa. Dept. of Agric., 3rd & 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 173–195. Pretoria: Govt. Printing & Stationery Office.

"1. A general discussion of the validity of the iodine titration method of Harris for the analysis of polysulphide mixtures is offered, and preference is given to the older methods involving the use of ammoniacal zinc chloride. In the presence either of free lime or free sulphuretted hydrogen, the iodine titration method countenanced for the analysis of lime-sulphur solutions, by the American Association of Official Agricultural Chemists, is altogether invalid, but by combining the ammoniacal zinc method with simple titration to standard acid, reasonably accurate results may be obtained, whatever be the composition of the polysulphide solution.

"2. The recent views of Ramsay and of Auld in regard to the nature of lime-sulphur solutions and to the reaction involved in their manufacture are discussed and criticized as invalid. Apart from the presence of thiosulphate, the dominant constituent is calcium pentasulphide, and 'polysulphide sulphur' is regarded as firmly combined. Even if huge excess of free lime over sulphur be used in preparation, the tendency always is towards formation of higher rather than lower polysulphides, the higher derivatives being stable even on boiling with free base.

"The possibility of the existence of derivatives above the pentasulphide is also discussed."

(209) BEDFORD (G. A. H.). Report upon the Dipping Trials carried out with the Different Proprietary and Home-made Sheep Dips in South Africa.—*Union of South Africa. Dept. of Agric., 3rd & 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 163–172. Pretoria: Govt. Printing & Stationery Office.

### Summary and Conclusions.

“Practical trials on a small scale were carried out with the following sheep dips available in South Africa:—

“ (1) Home-made Lime-sulphur Dip, (2) Capex Lime-sulphur Concentrate, (3) Modderfontein Lime-sulphur Concentrate, (4) Home-made Caustic Soda and Sulphur Dip, (5) O’Gorman’s Liquid Sulphur Dip, (6) Home-made Loogas-sulphur Dip, (7) Little’s Fluid Dip, (8) Hayward’s Paste Dip, (9) McDougall’s Powder Dip, (10) Cooper’s Sheep Dipping Powder, (11) Arsenite of Soda and Sulphur Dip, (12) Jeyes’s Fluid, (13) Kerol, (14) Leach’s Sheep Dip, (15) McDougall’s Tobacco Dip, (16) Dreadnought Tobacco Dip, (17) Magic Sheep Dip, (18) Home-made Tobacco Dip.

“From six to twelve sheep, very badly infected with scab, were used in each test. In the main series of trials two dippings at an immersion period of two minutes, and a dipping interval of nine days, were carried out—the nine-day interval having been previously established as just within the life-cycle of *Psoroptes communis*, var. *ovis*, in South Africa.

“The different batches of dipped sheep were tested for eradication of scab by being kept under observation in isolation stalls for six months after dipping.

“The general results showed successful cure of scab in all trials except one. The exception is represented by O’Gorman’s dip, but the failure in the case of one sheep is doubtless due to too high a dilution of the drum fluid as recommended in the directions for use. At higher tank strength this dip would also be effective.

“No attempt was made to place the various preparations in order of merit. This would have involved more extensive trials on a larger scale, and in any case it was not desired to draw invidious distinction between different proprietary articles.

“A few tests carried out at shorter immersion period and longer dipping interval indicated that, although such conditions might be effective, they could not be regarded as safe—especially in the absence of auxiliary hand-dressing, where time must be allowed for penetration of scab crust and where the danger of development of original infection is greater.

“The effect of the various dips upon the general health of the sheep, and upon the skin and wool, was not observed to be unfavourable except in the case of Leach’s dip, where obvious intoxication occurred in ten out of the twelve sheep dipped. The deaths occasioned in this case are attributed to the high concentration recommended for use. At lower concentration of tank fluid and with revised instructions for use this dip would probably be efficacious and innocuous. In regard to the recent controversy concerning the home-made sulphur dips there is every indication that these, if properly used, are both effective and harmless.

“As final conclusion it may be safely asserted that, with the exceptions indicated, *all the dips tested are permissible and effective in the cure of scab if properly used at an immersion period of two minutes and a dipping interval of nine days. Single dipping or dual dipping at a longer interval than nine days, or immersion of less than two minutes, may be effective in some cases, but cannot be relied upon.*

“The tests recorded are to be regarded as experimental in nature, and as serving as basis for more extensive trial in the field. The most interesting point in the laboratory trials is the apparent ease with which scab can be cured with almost any accredited dip.”

- (210) VELU. **Le traitement mercuriel chez le cheval et l'alopecie.**  
 [Mercurial Treatment in the Horse and Alopecia.]—*Rec. de Méd. Vét.* 1916. Apr. 30. pp. 134–136.

The author recently treated 40 horses and mules affected with epizootic lymphangitis by means of intramuscular injections of biniodide of mercury; the doses administered ranged from 1 to 3 grammes in all for each animal, or 10 centigrammes were given every alternate day over a period of 60 days.

In no case was observed the slightest sign of hydrargyrisms.

One subject only showed the classical symptoms of mercurial alopecia. This horse received the above treatment on alternate days. A month after the commencement of the treatment a considerable amount of oedema was noticed under the sternum, which extended towards the abdomen and the upper parts of the fore limbs. On the following days the usual train of symptoms exhibited by mercurial alopecia was observed, viz., an erythematous exudative dermatitis, loss of hair between the fore legs, on the shoulders, on the sides of the chest and at the base of the neck, and exfoliation of the epidermis. As the animal did not show any signs of mercurial intoxication and, in particular, no inflammation of the gums or salivation, treatment with biniodide of mercury was continued. The animal became rapidly restored to its normal condition and at the end of the treatment was completely cured of its lymphangitis and its alopecia.

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## REPORTS.

- (211) CEYLON. **Administration Reports 1915. Report of Government Veterinary Surgeon.** [STURGEON, G. W.] 8pp. f'cap.

### INFECTIOUS DISEASES.

*Horses.*—One case only of anthrax is reported.

*Cattle: Rinderpest.*—There was a considerable decrease in the number of outbreaks during the year. The numbers were as follows:—1,493 cases, number of recoveries 272, number of deaths 1,152, number shot 69. At the close of the year the island was free.

*Foot-and-mouth disease.*—Cases 2,366, recoveries 2,425 (including 128 cases at the end of 1914), deaths 49, balance ill at close of year 20. There was a considerable decrease compared with 1914, when 9,532 cases occurred.

*Surra.*—Bull treated with sodium arsenite, described in report for 1912–1913, remained in good health and no evidence of disease was shown by inoculation of its blood into a rabbit.

*Tuberculosis.*—This disease is rare in native cattle. A country-bred Ayrshire cow from imported parents which was suspected to be affected was tested with tuberculin. A well-marked reaction followed but no traces of tuberculosis could be found on post-mortem examination.

*Anthrax and haemorrhagic septicaemia.*—No serious outbreaks of these diseases occurred during the year.

*Epidemic amongst swine.*—An extensive outbreak of a disease resembling swine fever occurred in the Western Province, of a kind which had not previously been encountered for over 20 years.

Attention was first drawn to this disease by the condition of the carcase of a pig slaughtered at the Colombo abattoir. Its appearance pointed to a disease of the type of an acute haemorrhagic septicaemia. Evidence was obtained that this pig had been brought in from the seat of an extensive outbreak where pigs were dying in some villages by scores. Movement and sale of swine or pork were prohibited in infected villages and Inspectors were authorised to destroy suspected pigs, with the result that the outbreak rapidly subsided. The total number reported was 2,512 cases, 2,414 deaths, 1 recovery, and 97 shot.

The symptoms presented by affected pigs resembled those of acute swine fever in many respects, but the disease appeared to be of a different nature. In no case seen was cough or diarrhoea observed during life, or typical ulcerative lesions in the digestive canal or necrotic areas in the lungs, on post-mortem examination. Inoculation of a healthy young white European pig with 3 cc. of the filtrate from the blood of a dead pig gave a negative result. The disease also appeared in some respects like swine erysipelas, but in no case were the skin lesions characteristic, nor was any valvular complication of the heart noticed. Only in one instance was the heart involved, when the pericardium was found closely adherent to the heart wall.

The general symptoms were dullness, loss of appetite, constipation, catarrhal discharge from the eyes, a more or less diffuse, irregular, purple rash on the skin, and high fever, the temperature becoming subnormal during the later stages of the disease. Before death, giddiness, and tremors, of the head were common. Death usually occurred within a week. The mortality was between 90 and 100 per cent.

On post-mortem examination the lesions were not very pronounced. The heart was normal except in the case mentioned above where the pericardium was adherent. A yellow serous effusion was sometimes present in the pericardial sac. Petechiae were seen on the pleura; the lungs showed catarrhal pneumonia but were not extensively involved. A yellow serous exudate was generally present in the body cavities. The mucous membrane of the stomach was congested. The intestines showed haemorrhagic spots and ulcerative lesions. The mesentery was usually very congested. The lymphatic glands were as a rule much congested, but in some instances pale and watery. The liver was enlarged and dark in colour. Kidneys congested. Spleen normal.

At the time of the outbreak bubonic plague had appeared and was prevalent in the island. The disease did not appear to be either swine fever or swine erysipelas but an acute septicaemia or toxaemia of the nature of swine plague (*Septicaemia suum* or *Pasteurellosis suum*, *Pneumonie contagieuse du porc* in France, *Schweineseuche* in Germany.) Mr. E. BURGESS, Acting Director of the Bacteriological Institute, made a study of the disease and reference to the organism isolated by him has already been made in this *Bulletin* (Vol. 3, No. 4, Extract No. 256); a Gram-negative diplobacillus (or possibly a diplococcus) was described.

Sturgess has, however, been informed by the Medical Officer of Health, Colombo, who made a bacteriological examination of the first case reported, that bi-polar staining organisms were found in the heart blood, spleen and mesenteric glands. Mice inoculated with a trace of gland substance in sterile salt solution died within 24 hours. Broths inoculated from heart blood showed a pure culture of *Pasteurella surus*. Cultures in MacConkey's sodium taurocholate medium gave negative results using glucose, laevulose, mannite and galactose, while acid reactions were given in parallel cultures with *Bacillus pestis* (human plague). The organism showed bi-polar staining with all basic stains and was Gram-negative.

[The above disease is probably identical with the so-called swine plague described on the Continent of Europe. In England this is considered to be merely one form of swine fever. Further filtration experiments would have been necessary to convince one that the outbreak was not really one of swine fever.—Ed.]

*Cancerous Horn Disease of Cattle.*—Several cases of this disease occurred among dairy cows during the year. The disease is believed to be of a cancerous nature, and for some reason, unexplained at present, the right horn is the one affected. The epithelioma does not develop at the outset but after the horn is shed. The first lesion takes the form of cheesy material which entirely fills the horn. The bony core is entirely obliterated. This appears to be due to bacterial processes of a necrotic nature.

The early signs are a gradual drooping of the affected horn until it is almost down to the ear level. On manipulation it is movable, hot, and somewhat swollen at the base. It is quite soft and can be severed with a knife like cheese. It is not putrid unless an opening has been formed. Commonly, a slight blow while feeding or rubbing detaches it from the skull. The whole cavity is filled with cheesy material which is easily pulled out in masses.

It is then that the serious trouble commences. From one point or another or the marginal area of the skull cavity a malignant growth appears and resists all attempts to heal it. The only chance of successful treatment is amputation in the early stages, as soon as the affected horn is observed to be on a lower level than normal. As a rule early slaughter is advisable before the animal becomes emaciated and the carcass is ruined.

*Biting Flies.*—Specimens of flies causing worry to cattle in the Matale district were identified as *Haematopota singallensis*.

*Sarcoptic Mange in Goats.*—Goats in one district were noticed to be suffering a good deal from mange, which caused emaciation and death of badly infected animals. The presence of a sarcopt was easily detected in skin scrapings. Treatment by dipping in a solution of Izal 1 oz. to 1 gallon of water, followed by the application of a mixture of kerosene, sulphur and cocoanut oil was very effective in eradicating the disease.

(212) SOUTHERN RHODESIA. Report of the Director of Agriculture for the Year 1915.—22 pp. f'cap. 1916. Salisbury: Govt. Printer.

This includes the Reports of the Chief Veterinary Surgeon (SINCLAIR, J. M.) and of the Veterinary Bacteriologist (BEVAN, L. E. W.).

The greater part of the report of the Chief Veterinary Surgeon is devoted to African Coast fever of cattle. The total number of fresh outbreaks and mortality compare unfavourably with previous years, due to the extensive spread of infection in two districts. On the other hand it is recorded with satisfaction that a very large part of the country is now free from this disease.

The policy adopted in dealing with these outbreaks consists in temperature observations and isolation of sick and suspected animals, together with dipping at intervals of three days. When clean veldt is available the herds are moved into it from a temperature camp. A considerable increase in the number of dipping tanks available for the use of farmers has taken place in the course of the year.

Experience points out that the following results usually occur:—  
(1) Where dipping in solutions of proper strength had been regularly practised prior to an outbreak, the losses were infinitesimal; (2) where dipping had not been practised and where tanks were not immediately available, the losses were heavy; (3) where veldt is grossly affected to begin with, cases occur up to twelve months from the institution of regular dipping.

The existence of contagious abortion in cattle was discovered in October 1914, and since then several additional centres of infection have been discovered. The number of abortions observed in every instance was very small and Sinclair concludes that the disease is less virulent than in England because a "fair percentage of calves are born at the proper period." [He is here apparently misinformed, as the same occurs in infected herds in England.—Ed.]

Heavy losses were caused through such diseases as horse sickness, "blue tongue" in sheep, parasitic gastritis of cattle, and in young calves through white scour, etc.

*Report of the Veterinary Bacteriologist.*—No experimental work of interest has been performed. A vaccine for the inoculation of cattle against contagious abortion in cattle consists of an emulsion of the dead organisms. [This was proved to be useless by the Departmental Committee appointed by the Board of Agriculture in England to investigate this disease. Through producing specific agglutinins in inoculated animals, it has further the effect of vitiating the agglutinin test when applied to diagnose the existence, or the spread, of contagious abortion in a herd. The segregation of affected animals is thus rendered impracticable.—Ed.]

(213) GOLD COAST. **Report of the Veterinary Department for the Year 1915.** 8 pp. fcap. 1916. Accra: Government Press.

Nothing of interest, as far as tropical diseases are concerned, is contained in this report. The Veterinary Officer, Mr. W. P. B. BEAL, is being temporarily employed by the Veterinary Department of the War Office.

- (214) UNION OF SOUTH AFRICA. Department of Agriculture. The Third and Fourth Reports of the Director of Veterinary Research. November 1915.—632 pp. Pretoria: Government Printing & Stationery Office. [Price 3s. 6d.]

The results of a very large number of well-organised, expensive, and laborious investigations, undertaken by THEILER (Sir A.) and his staff, are detailed in these reports.

Most of the articles have been extracted for this Bulletin; the others are enumerated in the lists of "Recent Literature," not because of inferior value but on account of inability to extract them at present.

Unfortunately a few of the writers in these reports show a tendency to become rather involved in their descriptions. The following passage, for example, taken from WALKER's article on Anaplasmosis (p. 511), contains a number of inexcusable errors.

"An animal which had been previously inoculated with blood collected from a beast which was reacting to redwater, and in which redwater parasites were frequent, no apparent reaction to *P. bigeminum*; *P. bigeminum* anaplasmosis or *P. mutans* resulting (see experiment, No. 7.) When reinoculated with blood of another immune animal containing *P. bigeminum* and *P. mutans* infections gave a temperature reaction to redwater, but no redwater parasites were seen in the smears before, during, and after the reaction. (See experiment No. 16.) *P. mutans* appeared from the 54th day."

#### BOOK REVIEW.

- (215) ROGERS (Thomas B.). [D.V.S.] *Veterinary Handbook & Visiting List*.—119 pp. Demy. 1st Edition. 1916. Philadelphia & London: J. B. Lippincott Company. [Price 6s. net.]

In his preface the author makes no claims to originality for the subject matter of his book.

The first nineteen pages contain some very elementary information on bacterial therapy and prescription writing. The great bulk of the book, pages 20 to 107, consists of an enumeration of drugs together with the doses that may be administered to the domesticated animals. The visiting list at the end does not seem to display much advantage over a plain note book.

Probably few practitioners would consider the outlay on this book economical, as similar publications, perhaps of not quite equal value, are supplied to them gratis in this country by several firms of druggists.

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## RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 4, No. 2, pp. 87-88.]

## PROTOZOA.

- (216) CARINI (A.). Ueber die Hundekrankheit Nambi-Uvu und ihren Parasiten, *Rangelia vitalii*. [A Disease of Dogs, Nambi-Uvu and its Parasites, *Rangelia vitalii*.]—*Cent. f. Bakt.* 1. Abt. Orig., 1915. Dec. 29. Vol. 77. No. 3. pp. 265-271. With 2 plates.
- (217) CARINI (A.) & MACIEL (J.). Ueber *Pneumocystis carinii*. [*Pneumocystis carinii*.]—*Cent. f. Bakt.* 1. Abt. Orig., 1915. Sept. Vol. 77. No. 1. pp. 46-50. With 2 plates.
- (218) da CUNHA (A. M.). Sobre os ciliados intestinaes dos mamiferos II. [The Intestinal Ciliata of Mammals II.]—*Mem. do Inst. Oswaldo Cruz.*, 1915. Vol. 7. No. 2. pp. 139-144. With 1 plate.
- (219) ITURBE (J.) & GONZALEZ (E.). A New Trypanosoma of the *Vampirops lineatus*.—Pamphlet from Laboratory of Dr. Juan Iturbe, Caracas, Venezuela, 1916. 7 pp. With 1 coloured plate comprising 10 figs.
- (220) JOHNS (F. M.). The Centrifuge Concentration of Malaria Plasmodia for Diagnostic Purposes.—*New Orleans Med. & Surg.* June. Vol. 68. No. 12. pp. 765-768.
- (221) KING (W. V.). Experiments on the Development of Malaria Parasites in Three American Species of Anopheles.—*Jl. Experim. Med.*, 1916. June. Vol. 23. No. 6. pp. 703-716. With 7 plates.
- (222) LIGNOS (A.). La Leishmaniose canine à Hydra. [Canine Leishmaniosis at Hydra.]—*Bull. Soc. Path. Exot.*, 1916. May. Vol. 9. No. 5. p. 302.
- (223) MAGGIO (C.) & ROSENBUSCH (F.). Studien über die Chagaskrankheit in Argentinien und die Trypanosomen der "Vinchucas" (Wanzen, *Triatoma infestans* Klug.). ["Chagas" Disease in the Argentine and the Trypanosome of "Vinchucas" (Insects, *Triatoma infestans* Klug.).]—*Cent. f. Bakt.* 1. Abt. Orig., 1915. Sept. Vol. 77. No. 1. pp. 40-46. With 2 plates.
- (224) da MATTA (A.). Sur les leishmanioses tégumentaires. Classification générale des leishmanioses. [Tegumentary Leishmanioses. Classification of Leishmanioses.]—*Bull. Soc. Path. Exot.* 1916. July. Vol. 9. No. 7. pp. 494-503. With 2 plates comprising 12 figs.
- (225) SALVISBERG. Beitrag zur Behandlung der Coccidienruhr des Rindes. [Treatment of Coccidiosis in Cattle.]—*Schweiz. Arch. f. Tierheilk.*, 1916 July. Vol. 58. No. 7. pp. 369-373.
- (226) WESSELHOEFT (Conrad). i. The Early History of Malaria.—*New Orleans Med. & Surg. Jl.*, 1916. May. Vol. 68. No. 11. pp. 693-701. ii. The Discovery of the Cinchona Bark.—*Ibid.* pp. 702-714. iii. The Introduction and Early Use of Cinchona Bark.—*Ibid.* pp. 715-727.

## PARASITOLOGY.

## i. Helminths.

- (227) BAYLIS (H. A.). The Types of the Species *Ascaris* described by Baird.—*Parasitology*, 1916. June. Vol. 8. No. 4. pp. 411-419. With 3 text-figs.
- (228) BLANCHARD (R.). Quelques cas de pseudo-parasitisme et de xéno-parasitisme. [Some Cases of Pseudo-Parasitism and Xéno-Parasitism.]—*Bull. Soc. Path. Exot.*, 1916. July. Vol. 9. No. 7. pp. 522-541. With 2 text-figs.
- (229) BOULENGER (C. L.). Sclerostome Parasites of the Horse in England. 1. The Genera *Triodontophorus* and *Oesophagodontus*.—*Parasitology*, 1916. June. Vol. 8. No. 4. pp. 420-439. With 1 plate comprising 7 figs., and 7 text-figs.
- (230) HENRY (A.) & CIUCA (M.). Nouvelles recherches expérimentales sur la cénurcse du lapin. [Further Experiments on the Coenurosis of the Rabbit.]—*Ann. Inst. Pasteur*, 1916. Apr. Vol. 30. No. 4. pp. 163-179.
- (231) MEGGITT (F. J.). A Contribution to the Knowledge of the Tapeworms of Fowls and Sparrows.—*Parasitology*, 1916. June. Vol. 8. No. 4. pp. 390-410. With 3 plates comprising 23 figs., and 1 text-fig.
- (232) MEGGITT (F. J.). A Tri-Radiate Tapeworm (*Anoplocephala perfoliata* Goeze) from the Horse.—*Parasitology*, 1916. June. Vol. 8. No. 4. pp. 379-388. With 1 plate comprising 8 figs., and 2 text-figs.
- (233) RAILLET. La famille des Thelaziidae. [The Thelaziidae Family.]—*Jl. Parasit.*, 1916. Mar. Vol. 2. No. 3. pp. 99-105.
- (234) RAILLET. La résistance des trichines au froid. [Resistance of Trichinae to Cold.]—*Rec. de Méd. Vét.*, 1916. Jan. 15-Feb. 15. Vol. 92. Nos. 1 & 2. pp. 32-34.
- (235) RAILLET (A.) & HENRY (A.). Les Filaires des Rapaces [Falconiformes et Strigiformes.] [Filaria of Birds of Prey.]—*Bull. Soc. Path. Exot.*, 1916. June. Vol. 9. No. 6. pp. 364-369.
- (236) THEILER (A.) & ROBERTSON (W.). Investigations into the Life-History of the Wire-Worm in Ostriches.—*Union of South Africa, Dept. of Agric. 3rd & 4th Repts. of the Director of Vet. Res.*, 1915. Nov. pp. 291-346. With 9 plates comprising 22 figs.
- (237) WARD. Gonglyonema in the Role of a Human Parasite.—*Jl. Parasit.*, 1916. Mar. Vol. 2. No. 3. pp. 119-125. With 1 plate comprising 2 figs.
- (238) YOSHIDA (Sadao). On the Intermediate Hosts of the Lung Distome, *P. westermanni*, Kerbert.—*Jl. Parasit.*, 1916. Mar. Vol. 2. No. 9. pp. 111-117. With 1 plate comprising 6 figs.

## ii. Arthropods (Acari, Flies, Ticks).

- (239) BEDFORD (G. A. H.). Experiments and Observations carried out with *Psoroptes communis* at Onderstepoort.—*Union of South Africa, Dept. of Agric. 3rd & 4th Repts. of the Director of Vet. Res.*, 1915. Nov. pp. 99-112. With 6 text-figs. & 2 plates.

- (240) GRAHAM-SMITH (G. S.). Observations on the Habits and Parasites of Common Flies.—*Parasitology*, 1916. June. Vol. 8. No. 4. pp. 440-544. With 8 plates, 17 text-figs. & 9 charts.
- (241) HERMS (W. B.). The Pajaroello Tick (*Ornithodoros coriaceus* Koch). With Special Reference to Life History and Biting Habits.—*Jl. Parasit.*, 1916. Mar. Vol. 2. No. 3. pp. 137-142. With 1 fig.
- (242) LANGERON (M.). Remarques sur les larves du *Culex geniculatus* et sur les larves de Culicines pourvues d'un long siphon. [Larvae of *Culex geniculatus*, and of Culicines provided with a Long Siphon.]—*Bull. Soc. Path. Exot.*, 1916. July. Vol. 9. No. 7. pp. 438-442. With 7 text-figs.
- (243) LUTZ (A.), NEIVA (A.) & LIMA (A. C.). Sobre "Pupipara" ou "Hipposcidae" de aves brasileiras. [The "Pupipara" and "Hipposcidae" of Birds in Brazil.]—*Mem. Inst. Oswaldo Cruz.*, 1915. Vol. 7. No. 2. pp. 173-197. With 2 plates.
- (244) WALKER (J.). A Short Note on the Occurrence of *Cytodites nudus* (Vizioli) in the Domestic Fowl in South Africa.—*Union of South Africa. Dept. of Agric. 3rd & 4th Repts. of the Director of Vet. Res.*, 1915. Nov. pp. 575-582. With 1 plate comprising 3 figs.

#### BACTERIA, ULTRAVISIBLE VIRUSES, etc.

- (245) BULL (C. C. G.). Further Observations on the Agglutination of Bacteria *in vivo*.—*Jl. Experim. Med.*, 1916. July 1. Vol. 24. No. 1. pp. 25-34. With 1 plate comprising 5 figs.
- (246) FISCHER (J.). Untersuchungen über die Darmflora beim gesunden Ochsen. [The Intestinal Flora in Healthy Cattle.]—*Cent. f. Bakt.* 1. Abt. Orig., 1915. Sept. Vol. 77. No. 1. pp. 6-39.
- (247) GOOD (E. S.) & CORBETT (L. S.). A Study of Gas-Production by Different Strains of *Bacillus abortivo-equinus*.—*Jl. Infect. Dis.*, 1916. June. Vol. 18. No. 6. pp. 586-595.
- (248) MELLO (Ugo). Observations et considérations sur une vaste enzootie de blépharo-conjonctivite chez le cheval. [A Wide-spread Enzootic of Blepharo-Conjunctivitis in the Horse.]—*Nuovo Ercol.*, 1914. Dec. Nov. 20-Dec. 20. (Extracted in *Rev. Gén. de Méd. Vét.*, 1916. June. Vol. 25. No. 294. pp. 267-268.)
- (249) MITCHELL (D. T.). Investigations into Jagziekte or Chronic Catarrhal-Pneumonia of Sheep.—*Union of South Africa. Dept. of Agric., 3rd & 4th Repts. of the Director of Vet. Res.*, 1915. Nov. pp. 585-614. With 2 plates comprising 8 figs.
- (250) MORI (Nello). Studio su di una epizootia di Vaiò'o manifestatasi nei bufali e negli equini della Piana di Salerno, con vari casi di trasmissione all'uomo. [An Outbreak of Variola among Wild Oxen and Horses in the Piana di Salerno with Some Cases of Transmission of the Disease to Man.]—*Giorn. Med. Vet.*, 1916. June 24 and July 1. Vol. 65. Nos. 26 & 27. pp. 577-588 & 604-613.
- (251) PORCHER (C.) & GODARD (P.). Le lait et la fièvre méditerranéenne. [Milk and Malta Fever.]—*Bull. Soc. Path. Exot.*, 1916. May. Vol. 9. No. 5. pp. 285-286.

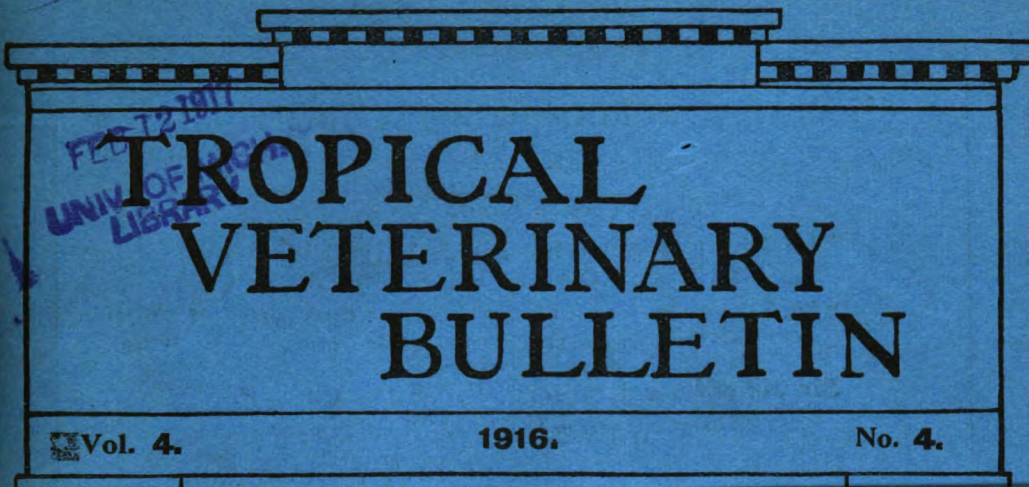
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- (253) DON (G.). Report on *Acokanthera venenata*, G. Don, from the Transvaal.—*Union of South Africa. Dept. of Agric. 3rd & 4th Repts. of the Director of Vet. Res.*, 1915. Nov. pp. 617-623. With 5 text-figs.
- (254) GREEN (H. H.). Arsenical Dip-Tester.—*Union of South Africa. Dept. Agric. 3rd & 4th Repts. of the Director of Vet. Res.*, 1915. Nov. pp. 197-214. With 5 text-figs.
- (255) PHISALIX (Mme. M.) & CAIUS (R. P. F.). Propriétés venimeuses de la salive parotidienne chez des Colubridés aglyphes des genres *Tropidonotus* Kuhl, *Zamensis* et *Helicops* Wagler. [Venomous Properties of the Parotid Saliva in the Non-poisonous Colubrines.]—*Bull. Soc. Path. Exot.*, 1916. June. Vol. 9. No. 6. pp. 369-375.
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- (259) VIALLATTE (Ch.). Rapport sur le fonctionnement du laboratoire de microscopie de Beni-Abbès (Sahara Oranais) en 1915. (Note III le "Debab," IV. Sur les embryons de filaire dans le sang du cheval. V. Sur une Myiase cavitaire du dromadaire). [Report on the Work of the Laboratory of Microscopy of Beni-Abbès (Sahara Oranais) in 1915. III. "Debab." IV. Filarian Embryos in the Blood of the Horse. V. Cavitory Myiasis of the Dromedary.]—*Bull. Soc. Path. Exot.*, 1916. July. Vol. 9. No. 7. pp. 469-486.

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# TROPICAL VETERINARY BULLETIN.

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VOL. 4.]

1916.

[No. 4.

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## PROTOZOOLOGY.

### (a) COCCIDIOSIS.

(260) BATES (L. B.). *Coccidiosis of Calf.*—*Proc. Med. Assoc. Isthmian Canal Zone.* 1915. Apr. to Dec. Vol. 8. Pts. 1 & 2. pp. 92–94.

In this short note the author describes a case of coccidiosis in a calf kept for experimental purposes at the Board of Health Laboratory, the Panama Canal.

Outbreaks of coccidiosis had appeared very frequently among rabbits kept at the laboratory, sometimes even killing off the entire supply. The calf in question had been placed for a few days in a field in which the rabbit hutches were situated. On the sixth day after returning to its shed the calf commenced to pass small quantities of blood with its faeces; on the next day the amount of blood increased, and on the third day the excreta consisted almost entirely of blood, some of the clots being as large as a fist. The discharges had an extremely foul odour. The blood ceased on the fifth day but the diarrhoea continued for several days longer, the discharge consisting of mucus with the same foul odour. Throughout the attack the calf retained its appetite, but it lost weight rapidly. The animal was then disposed of and no further examination was made.

Bacteriological examination of the faeces as to the presence of human bacillary dysentery proved negative. On the third day of the disease the faeces were examined under a low power of the microscope and about 20 coccidia were found per field. These averaged about  $60\mu$  long by  $40\mu$  in width.

(261) CREMONA (P.). *Contributo allo studio della coccidiosi degli uccelli.* [Avian Coccidiosis.]—*Nuovo Ercolani.* 1916. Oct. 10–20. Vol. 21. Nos. 28–29. pp. 472–474.

In this short article the author describes the occurrence of intestinal coccidiosis in the sea swallow (*Sterna hirundo*) and in the seagull (*Larus ridibundus*).

Extreme emaciation and diarrhoea before death were noted in both cases. The parasite from the sea swallow is stated to have been oval or elliptical in shape, measuring from 25–35 microns long by 15–20 broad. Otherwise no study of the parasites seems to have been made.

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## (b) BIRD MALARIA.

- (262) DE MELLO (F.) & BRAZ DE SA (L. J.). **A Contribution to the Study of Haemoprotozoa in Portuguese India.**—*Indian Jl. Med. Res.* 1916. Apr. Vol. 3. No. 4. pp. 731–737. With 1 coloured plate comprising 42 figs.

(1) *Schizogonic Cycle of Haemoproteus Columbæ*.—The authors confirm the findings of the SERGENT brothers that the halteridium of the pigeon has no flagellate phase in its developmental cycle. Pure haemoproteus infection without accompanying trypanosomes was noted. Their work confirms the descriptions given by ACTON and KNOWLES [see this *Bulletin*, Vol. 2, No. 4. Extract No. 343] with the following exceptions:—Forms with chromatin fission were found not only in the lungs but also in the heart blood. The chromatin division was not a regular binary process and the nuclear masses formed became transformed into chromidial dust as they were produced. Circular forms with centrally placed nucleus surrounded by chromidial dust were not observed. The name *Acton body* is given to the free schizogonous form in the plasma and *merozoblast* to the later stage which gives origin directly to the merozoites and contains no nucleus but only idiochromidia.

(2) *Haemoproteus moruony* N.SP.—This parasite was discovered in the blood of a common singing bird, the “madwana” or “moruony,” *Copsychus saularis* (Linn.). The general features of this parasite resembled those of *H. columbæ*, but with the important difference that all stages of its development were seen in the blood and no special forms were found in the internal organs.

(3) *Note on a Plasmodium found in Bats*.—A list of the species of Plasmodium hitherto found in bats is given. Two out of 11 specimens of *Vespertilio muricola* were found infected with the parasites of bat malaria and the schizogonic cycle is illustrated in the plate. The following points are noted in connection with the parasite:—(1) Bacillary forms of the young parasite occur; (2) precocious division of the chromatin; (3) constancy of six merozoites in the *rosetta*; (4) circular or ovoid-shaped gametocytes. The name *P. mackiei* is proposed for this parasite. The bats were infected with ectoparasites of the family *Nycterobiidae*. Nothing is known of the sporogony.

## (c) HERPETOMONIASIS.

- (263) FANTHAM (H. B.) & PORTER (Annie). **The Significance of Certain Natural Flagellates of Insects in the Evolution of Disease in Vertebrates.**—*Jl. Parasit.* 1916. June. Vol. 2. No. 4. pp. 149–166. With 1 table & 2 figs.

In this paper the authors summarise the results of experiments which have been conducted by them for a number of years in order to ascertain whether certain of the parasitic Mastigophora, notably members of the genera *Herpetomonas* (or Leishmania-like bodies) and *Critidia* (or bodies such as the forms which some trypanosomes assume in their development in the bodies of insects or in culture), when introduced into the bodies of vertebrates by ingestion of infected insects or by way of wounds or abrasions of the skin, exert pathogenic effects on the host.



The flagellates used in these experiments comprise *Herpetomonas jaculum* Léger, parasitic in the gut of the Hemipteran, *Nepa cinerea*; *H. stratiomyiae* Fantham and Porter, from the intestine of the Dipteran, *Stratiomyia chameleon*; *H. pediculi* Fantham, from the alimentary tract of *Pediculus vestimenti*; *H. culicis* Novy and MacNeal, from the larvae and adults of the gnat, *Culex pipiens*; and *Crithidia gerridis* Patton, parasitic normally in the alimentary tract of the Hemipteran, *Gerris paludum*.

The vertebrate hosts included representatives of the Pisces (stickleback, *Gasterosteus aculeatus*); Amphibia (frog, *Rana temporaria*, toad, *Bufo vulgaris*, and newt, *Molge vulgaris*); Reptilia (lizard, *Lacerta vivipara*, and grass snake, *Tropidonotus natrix*); Aves (canary, *Serinus canarius*, sparrow, *Passer domesticus*, and martin, *Chelidon urbica*); and Mammalia, (dog, *Canis familiaris*, and mouse, *Mus musculus*).

The insect flagellates were introduced into their respective vertebrate hosts either by inoculation or feeding. Blood films were made periodically during the life of the infected animals and smears of the internal organs at autopsy.

The results of these experiments are best given in the following summary of the authors:—

“(1) Herpetomoniasis can be induced in various warm and cold-blooded vertebrates when the latter are inoculated or fed with herpetomonads occurring in the digestive tracts of various insects. The infection produced and the protozoal parasites found in the vertebrates resemble those of human and canine leishmaniasis.

“(2) An infection can also be induced in certain vertebrates when they are fed or inoculated with *Crithidia gerridis*, and both flagellate and non-flagellate stages occur therein, but no transition to a trypanosome was found.

“(3) The following Flagellata have been proved pathogenic to warm-blooded vertebrates when the latter have been fed, or inoculated subcutaneously or intraperitoneally with them—*Herpetomonas jaculum*, *H. stratiomyiae*, *H. pediculi*, *H. ctenocephali*, *H. culicis*, and *Crithidia gerridis*. The hosts used were mice of various ages, dogs, canaries, sparrows and martins.

“(4) *Herpetomonas jaculum* and *Crithidia gerridis* have also been successfully fed or inoculated into cold-blooded hosts, namely, fishes (*Gasterosteus aculeatus*), frogs, toads, lizards (*Lacerta vivipara*) and grass-snakes (*Tropidonotus natrix*).

“(5) The disease induced may run an acute or a chronic course. In the acute cases among our vertebrates the flagellate form of the parasite was the more obvious at death. In chronic cases, non-flagellate forms of the parasite were more numerous.

“(6) Natural herpetomoniasis of a pigeon has been recorded by Drs. Edm. and Et. Sargent in Algeria. This affords a parallel case with the natural and induced herpetomoniasis of mice as recorded by us.

“(7) The flagellate stage of *Leishmania donovani* in vertebrates is now known, and that of *L. tropica* in man has been known for some time. The links completing the evidence that a *Leishmania* is morphologically a *Herpetomonas* are thus complete. We believe that leishmaniasis are invertebrate-borne herpetomoniasis, and that these maladies have been evolved from flagellates of invertebrates (especially herpetomonads of insects), which have been able to adapt themselves to life in vertebrates.

“(8) In areas where leishmaniasis are endemic an examination should be made of all insects and other invertebrates likely to come into contact with men or dogs or domestic vermin like rats and mice, in order to ascertain if these invertebrates harbour herpetomonads. Preventive measures should be directed against such invertebrates, especially arthropods. Further, it is likely that members of all classes of vertebrates, and

especially those members that are insectivorous, may serve as reservoirs for leishmaniasis, or as they should preferably be termed, herpetomoniasis. The virus may exist in such reservoirs in a very attenuated condition and so be difficult of detection. From these sources the herpetomonads may reach man by the agency of ectoparasites or flies, especially such as are sanguivorous."

(d) SARCOSPORIDIOSIS.

(264) CRAWLEY (H.). *The Sexual Evolution of Sarcocystis muris*.—*Proc. Acad. Nat. Sci. Philadelphia*. 1916. Jan. pp. 2–43. With 4 plates comprising 93 figs.

For the investigations described in this paper mice were fed with the muscles of mice infected with Sarcosporidia, and killed at intervals varying from 1 up to 24 hours. The entire alimentary canal was then removed and placed in an appropriate fixing solution (Hermann's fluid, picro-acetic acid, or alcoholic-corrosive-acetic mixture).

After fixation the small intestine was cut up into 25 to 30 pieces which were numbered, and selected pieces were then embedded in paraffin and sections cut. The best staining results were obtained with iron haematoxylin.

Exfoliation of the intestinal epithelium, as first signalled by ERDMANN (1910), was noted to occur in varying degrees.

The evolution of the Sarcosporidia within the epithelial cells of the small intestine is depicted semi-diagrammatically in the series of figures accompanying the article, the greater part of which is devoted to a description of the evolution of the parasites as depicted in these figures. The rapid differentiation and evolution of the sarcocysts is best described in the author's own summary, which is as follows:—

"(1) The spores of *Sarcocystis muris*, ingested by a mouse, may reach the posterior part of the small intestine within one hour.

"(2) Invasion of the epithelium cells of the intestine may also take place within the same time.

"(3) Upon reaching the lumen of the intestine, the spore rapidly undergoes changes. The nucleus becomes larger and more conspicuous, and a distinct nuclear net becomes evident. The granules characteristic of the spore as it occurs in the cyst either disappear or become much less evident. Further changes, however, do not take place unless the spore gains an intracellular situation.

"(4) The spores are sexually differentiated, but it does not appear to be possible, at the outset, to distinguish between the males and females.

"(5) Within the mouse cells the changes undergone by the males, or microgametocytes, begin to be evident at the end of 1½ to 2 hours.

"(6) These changes are, first, a further increase in the size of the nucleus accompanied by a further development of the nuclear net, and, second, degeneration and ultimate disappearance of the cytoplasm. The cell contours become rough and irregular, vacuolization occurs, the cytoplasm becomes reduced to two masses of debris lying at the ends of the nucleus. These finally disappear, the entire process usually being completed at the end of six hours. The microgametocyte is thus reduced to its original nucleus, which, however, is of approximately the same size as the original spore.

"(7) Conspicuous internal changes next take place, which modify both the morphology and chemistry of the parasite. They may be considered under three headings, but they all take place more or less simultaneously.

"(a) The chromatin appears to suffer a loss in actual bulk, but alters in staining reaction from acidophil to basophil.

"(b) From occurring in large irregular masses or distributed along the threads of the linin net in strips or bands, the chromatin is

reduced to granules which become progressively smaller and smaller and at the same time display a greater and greater affinity for chromatin stains.

"(c) These granules finally assemble in clusters around the periphery of the organism.

"(8) The next step is the solidification of these granular clusters into rounded, solid balls. These balls next elongate and become minute, thread-like bodies, which are the microgametes. This stage may be found in mice killed from 9 to 18 hours after inoculation. It is very rare in the shorter of these two periods, but has apparently passed its acme at the end of 18 hours.

"(9) The females go through with their development side by side with the males, but there are no such conspicuous changes and the early female stages are much like the spore which has just entered the cell.

"(10) In the course of a few hours, however, the females can be picked out, appearing as broadly oval cells, relatively shorter and broader than the original spores. The cytoplasm is all retained and assumes a rather dense alveolar texture. The nucleus shows no evident increase in size. The nuclear net does not develop as it does in the male parasite, but the chromatin concentrates into a single large karyosome which maintains an acidophil rather than a basophil staining reaction.

"(11) In the 6- to 15-hour periods, phenomena are seen which seem best interpreted by regarding them as maturation. Irregular chromatin granules appear in close association with the nuclear membrane. Later these granules pass out into the cytoplasm, and finally disappear.

"(12) The mature female, or macrogamete, may be found in mice killed from 11 to 18 hours after inoculation.

"(13) Finally, in the 18-hour stages, macrogametes may be found which in some cases show minute, thread-like bodies upon their surfaces, and in others contain within their substances small solid chromatic bodies, one in each case. These appearances are regarded as warranting the interpretation that fertilization takes place."

(265) CRAWLEY (H.). **The Zoological Position of the Sarcosporidia.**—*Proc. Acad. Nat. Sci. Philadelphia.* 1916. June. pp. 379-388.

In this paper the author describes certain phenomena which have been observed to occur in the course of the evolution of the Sarcosporidia, suggesting that they are in many respects very nearly related to the Coccidia.

Following DOFLEIN'S (1911) classification of the Protozoa the Sarcosporidia are thus grouped as a sub-order of the order Coccidioromorpha (sub-class Telosporidia, class Sporozoa), and not among the Neosporidia as has been hitherto customary to classify them.

The following is the evidence on which the author bases his theory:—

FANTHAM (1913) in the case of *Sarcocystis colli* speaks of two kinds of spores.

The author himself in the case of *Sarcocystis muris* (see above Extract, No. 264) showed that the spores are differentiated into males and females which quickly develop along their respective lines within the intestinal cells of the mouse; fertilisation takes place but no stage was observed beyond the fertilised zygote.

ERDMANN (1914) describes multiplication stages of a parasitic protozoan in the intestinal cells and tissues of mice killed some days after ingestion of spores. These are apparently derived from the zygotes. About the 45th day the parasite appears in the muscles.

NÈGRE (1907), and recently, the author himself have demonstrated that the faeces of infected mice are capable of infecting a clean mouse on ingestion.

The history of the muscle stages is obscure.

NEGRI (1910) found, in a rat killed 50 days after feeding, the smallest and youngest stage to be about 25 microns long. These bodies, which he termed sporoblasts, divided repeatedly until the cyst became formed.

BERTRAM (1892) describes similar stages in the evolution of *S. tenella* in the muscles of the sheep.

The author himself recently discovered single bodies and groups of 2 and 8 sporoblasts in the case of *S. tenella* in the heart of the sheep, thus furnishing direct evidence that the sarcosporidian cyst originates from a single cell.

The life-history of *Sarcocystis muris* may thus be divided into three portions, viz., (1) sexual development which takes place in the intestinal epithelium, (2) the obscure stage which follows, in which it is conceivable that it is the encysted zygote that infects the faeces, and (3) the stage which occurs in the muscles.

The sarcosporidian "spore" is assumed to be the homologue of the coccidiomorphan merozoite, the sexual stages of both being alike. The multiplication products of the sarcosporidian zygote are supposed to be the homologues of either the spores or sporozoites of the Coccidiomorpha. The sporoblast is not so easy to place. It may correspond to either the sporozoites or the trophozoites of the Coccidiomorpha. A knowledge of its derivation is necessary before this point can be determined. The sarcosporidian muscle stage seems to be homologous with the entire schizogonous cycle of the Coccidiomorpha.

To account for the widespread occurrence of Sarcosporidia in purely herbivorous animals, such as sheep, the author suggests that a second host, a carnivorous animal, infects itself by eating the infected flesh of the former; the merozoites subsequently released in the intestine initiate the sexual cycle, and the encysted form is then discharged in the faeces. In the case of omnivorous animals, such as mice, the existence of a second host would appear to be unnecessary.

#### (e) PIROPLASMOSIS.

(266) BIMBI (P.). *La Piroplasmosi equina in Sardegna*. [Equine Piroplasmosis in Sardinia.]—*Moderno Zoiatro*. Parte Sci. 1916. Sept. 30. Vol. 5. No. 9. pp. 225-233.

This article is concerned with a clinical study of equine piroplasmosis in Sardinia. The disease was discovered for the first time in the island by BARUCHELLO and PRICOLO in 1908. It exists in an enzootic state throughout the island, especially in the provinces of Cagliari and Sassari, the one a flat marshy district containing numerous ticks, and the other at a much higher altitude.

The author refers to the studies of NUTTALL and STRICKLAND (1912), and of CARPANO (1913) in Italy. These authors demonstrated that the disease may be produced by two distinct intra-corporal parasites, viz., the *Nuttallia equi* and *Babesia caballi*, of which the former appears to be the most widespread.

Bimbi maintains that the disease in Sardinia, according to its clinical manifestations, is without exception a babesiasis.

CARPANO showed that the transmitting ticks in Italy were the *Rhipicephalus bursa* in the case of *N. equi*, and *Margaropus annulatus* in the case of *B. caballi*. The author believes that the latter tick is the sole transmitter in Sardinia.

The disease is seasonal in distribution and cases occur during the hotter part of the year, i.e. from May to September. Nuttalliasis on the other hand, according to CARPANO, breaks out during the colder part of the year.

Native Sardinian horses appear to possess a high degree of immunity; at least clinical cases are never seen. All the cases of piroplasmosis observed occurred among imported horses, viz., Hungarian horses belonging to the various posts of mounted police (*carabinieri*). Cases nearly always occur singly.

The disease invariably runs an acute or sub-acute course, characterised by high fever—up to 40·9° C.—lasting from five to eight days, after which the temperature falls to nearly normal. Other symptoms are marked icterus and nervous prostration, which, however, is never so serious as in the case of nuttalliasis, where paresis or even paralysis of the hind quarters may occur. Petechiae sometimes occur. The urine is slightly more highly coloured than normal, but it is never blood-tinged as in the case of nuttalliasis. Following on these acute symptoms the disease runs a benign course and always ends in the recovery of the affected animal. Chronic forms as in nuttalliasis are not seen.

Quinine has given very good results in the treatment of the disease when administered in repeated small doses. Accordingly, about 2·5 grammes of quinine hydrochloride dissolved in 10 cc. of sterile distilled water are injected subcutaneously two or three times a day for three or four days in succession and then once every two or three days. The drug is apparently very beneficial in shortening the convalescent period.

On account of the blood destruction and anaemia produced by the disease convalescence is long, the anaemia lasting from 24 to 30 days, and hence the author recommends a long period of rest during which good nursing should be applied, accompanied by the administration of drugs such as cacodylate of soda and strychnine.

- (267) MARKOFF (W. N.). **Piroplasmose und andere blutparasitäre Krankheiten der Haustiere am Balkan.** [Piroplasmosis and Other Diseases of Domesticated Animals due to Blood Parasites in the Balkans.]—*Arch. f. Schiffs- u. Trop.- Hyg.* 1916. July. Vol. 20. No. 14. pp. 313–335.

The author's observations were made for the most part during the first Balkan Wars in 1912–1913 and during the year 1914 in the various places occupied by the Bulgarian Army.

#### *Equine Piroplasmosis.*

The author first gives an account of the distribution of the disease in the Balkan Peninsula and from these facts he concludes that the disease originally came from Southern Russia and spread down along the coast of the Black Sea over the Danube. It then reached the

Dubrudja and later spread from the Black Sea coast towards Bulgaria and further south towards the Strandja Mountains into Turkey until it came to Tschataldja. From this place it apparently spread over the Bosphorus into Armenia, Persia, and then towards the Caucasus until it came back again into Southern Russia.

A short description is then given of the reported occurrence of the disease in various parts of the world by different authors, together with the transmitting ticks.

In the Balkans the only transmitting tick seen was the *Dermacentor reticulatus*, which is also the vector in Southern Russia, and it was observed that as soon as horses became covered with these ticks cases of piroplasmosis occurred.

The causal agent appears to be of the type *Piroplasma bigeminum*. At first no parasites could be seen in blood smears although the horses showed unmistakable symptoms of piroplasmosis. As in BILITZER'S observations (1906) in Southern Russia, it was thought that the disease was equine influenza. On further examination the parasites were found in the blood of several horses; in one case as many as nine could be seen in among 26 red corpuscles in a field of the microscope. Several parasites could be seen laying free in the plasma. No organisms of the *Parvus* type were ever observed, i.e., forms in which the elements are arranged in the form of a cross. The majority were pear-shaped or conical, sometimes long-shaped elliptical, ring-shaped prismatic, and seldom spindle-shaped. In the case of the pear-shaped parasites growth was often seen to take place from the points and from the broad ends, in the latter case then reminding one of a figure 8. The bodies lying free in the plasma had exactly the same form and appearance as the intracorpuseular elements. The chromatin was very varied in form, size, quantity, and arrangement. It was very often seen free in the plasma and collected into masses. The parasites attained from one-third to one-eighth the size of the red corpuscles and lay in different parts of the corpuscles.

In the case of two horses piroplasma-like structures destitute of chromatin were seen in the blood, for the most part free in the plasma. The margins stained rather intensely. The blood corpuscles in the case of these animals showed no changes except that there was apparently a marked leucocytosis. These animals had developed a temperature of about 1° C. above normal, which lasted from two to three days and then disappeared. The bodies were not then seen in the blood. The peculiar structure of the organisms was probably due to the individual resistance of the animals.

Clinically, the disease was observed to be for the most part acute, seldom chronic, and in one case relapsing. The temperature at first rises 2° or 3° C. above normal and this febrile period lasts only a few days and the temperature then falls. During the febrile period other symptoms appeared such as general weakness, uncertain gait, and icterus of the visible mucous membranes, which are usually of a saffron-yellow colour. The icterus lasts from about 7 to 13 days, but in rare cases it may be absent. In severe cases petechiae appear. The pulse is weak and irregular and the respiration weak and accelerated, except in the case of lung complications.

At Tschataldja following on a severe winter in which the horses suffered from scarcity of food the author noticed in later months

(April, May, and June) complications in the form of subcutaneous swellings accompanying the disease. These were about the size of an egg to start with, but later reached a length of 50 to 60 cm. or more at their greatest diameter. As a rule they affected the breast and the sheath but sometimes the neck, chest, and the head. They were cold, painless, and firm in consistence and lasted from about a week up to one or two months in some cases. Abscess formation did not take place.

The alimentary tract was not affected. The nervous system during the febrile period is somewhat dulled and the animal often exhibits a somewhat uncertain gait. Change in the colour of the urine was only observed in two cases and in these it was only chestnut-brown, not red. The blood was pale and watery looking.

According to the author's observations the disease lasts without complications from seven to eight days up to three weeks, and terminates favourably. In cases where the disease is not observed and the animals worked complications are often seen in the lungs and other organs. The mortality ranges between 5 and 12 per cent.

On post-mortem examination the following changes are found: general anaemia accompanied by icterus; in the peritoneal cavity about a litre of serous exudate; liver yellowish and slightly enlarged, friable; spleen greatly enlarged, soft in consistence, and intensely congested on section; kidneys likewise show degenerative changes together with infiltration under the capsule. Stomach and intestines often show a diffuse inflammation. The thoracic organs are congested; there is a serous exudate in the pericardial sac. The blood corpuscles show the usual anaemic changes.

The author then gives a history of the outbreaks he has dealt with.

The disease has to be differentiated from various poisonings, anthrax, equine influenza, and purpura haemorrhagica.

The various methods of immunisation devised by THEILER, CARPANO, and BILTZER, respectively, are enumerated.

With regard to treatment two or three injections of trypanblue are recommended in severe cases. Otherwise medicines should be avoided.

#### *Bovine Piroplasmosis.*

This disease, commonly known as "Krtschan," has been known in Bulgaria since the earliest times; its etiology was first discovered in the country by TATSCHOFF (1893). It is found in every part of the country and during the Balkan war was seen by the author in Thrace, Macedonia, Turkey, etc. The disease is transmitted not only by *Ixodes ricinus* but by several other, unknown, ticks.

Two types of parasites are seen in the blood. The majority appear to be of the type *Babesia bovis* whilst the others, according to their size, resemble *B. bigeminum*. These differences have been described by KNUTH. BOIKINOFF found that the blood parasites of cattle affected with redwater in the mountains seemed to be much smaller in size than other known cattle piroplasms.

The disease may be acute or chronic and the symptoms correspond with those of redwater in other countries.

Reference is made to a redwater of cattle discovered by ANGELOFF in the Rhodope mountains. This resembled the disease known as

“Stallrot” in Germany, Belgium and France. No piroplasm was found in the blood which, however, showed marked anaemic changes including especially the presence of basophile granules in the red corpuscles.

*Piroplasmosis of Sheep.*

This also is known under the name of “Krtschan” or “May disease.” It appears in the late spring and occurs in all parts of the Balkan Peninsula, causing great loss. Sheep imported from Russia for cross-breeding purposes always succumb.

*Dourine.*

A few cases were introduced into the country in horses imported for breeding purposes. The disease has now been stamped out. In the neighbouring countries, Serbia, Turkey, and Greece, the disease has always been unknown.

The author gives a description of the symptoms observed and the difficulty in finding the parasite in the blood and excretions.

*Fowl Spirochaetosis.*

This disease has been observed by the author and described by others in Bulgaria; it occurs in Roumania, and apparently also in Serbia and Turkey. The transmitting tick is *Argas persicus*.

Successful results were obtained by treating infected fowls with the blood of an ass immunised with blood containing spirochaetes. The successful treatment of spirochaetosis by means of normal heterologous sera has already been described by the author.

(f) TOXOPLASMOSIS.

(268) PLIMMER (H. G.). **Notes on the Genus *Toxoplasma*, with a Description of Three New Species.**—*Proc. Roy Soc.* 1916. Aug. 1. Series B, Vol. 89. No. B 616. pp. 291–296. With 2 plates, comprising 10 figs.

Plimmer first contributes some general notes and a brief history of the literature dealing with the genus *Toxoplasma* since the organisms were first seen by SPLENDORE in 1908. He believes that they are more nearly related to the haemogregarines than to any other of the Haemosporida. They are generally found in the large mononuclear leucocytes and they give rise to very marked wasting and to considerable blood destruction.

On account of the very fine, delicate and sometimes vacuolated nature of the protoplasm fixation is difficult, and the best method of fixing was found to be by means of the vapour of iodine dissolved in chloroform, as described previously by the author [see this *Bulletin*, Vol. 1, p. 282].

In many of the organisms the nucleus is either broken up into granules or the cell gets filled up with granules which take chromatin stains. These granules may be the so-called “infective” granules, such as have been described by FRY and RANKEN in trypanosomes.



There is a tendency for the leucocytes which have become enormously enlarged owing to the invasion by the parasites to mass themselves together, but no true giant cells are formed. Multiplication is effected ordinarily by longitudinal division. The nucleus first enlarges, then becomes rod-shaped, later of a dumb-bell shape and eventually the daughter nuclei are formed, the cell having already begun to divide. No flagellated forms have been seen. Many attempts at cultivation in various media were made but none were successful. The varieties described were found in the following animals in the course of post-mortem examinations of animals which had died in the Zoological Gardens, London.

“(I) Fossa (*Cryptoprocta ferox*), from Madagascar.

“The animal was very wasted. Both pleural, peritoneal, and pericardial cavities contained a quantity of blood-stained fluid. The lungs and kidneys were very congested, and there was a layer of lymph on the under-surface of the diaphragm. The blood was extremely anaemic and contained many poikilocytes and nucleated erythrocytes. A few toxoplasmas were found in the blood; many were found in the blood from the lung, and in the pleural and peritoneal exudation, and in the bone-marrow. Few were found free; nearly all were contained in the large mononuclear leucocytes, often a great number, as many as 36, in a single leucocyte. The leucocytes were very much enlarged, and their protoplasm was extremely thin and delicate, many being ruptured in the preparation of the film, even with the greatest care. The nucleus of the leucocyte invariably showed signs of hyperchromatosis, often very marked. The nucleus of the parasite was often broken up into granules, or chromidia, but many showed the single dot form with a clear area around. Sometimes the *Toxoplasma* was found in the nucleus itself. Schizonts were found in the bone-marrow in various stages up to the apparent breaking up into merozoites. Occasionally the parasites were found in the polynuclear cells in the bone-marrow; this was possibly a phagocytic process, as the shapes of the ingested parasites were much altered.”

The organism varied from 2 to 8 microns in length from end to end and from 1.4 to 2.5 microns in breadth at the middle.

“(II) Blue-tailed Fruit Pigeon (*Carpophaga concinna*), from the Aru Islands.

“Died in an emaciated condition. The lungs were very congested, and contained a very large quantity of exudation.

“There was some bloody fluid in the body cavity. Very few parasites were found in the blood, but large numbers were present in the blood and exudation from the lungs. Some were found free, but they were mostly contained in the large mononuclear leucocytes. These cells had undergone more destruction than was the case in the fossa, and the blood was extremely anaemic. The nucleus of the *Toxoplasma* was generally single and definite, and was not broken up into granules. A few were found in the bone-marrow, but none showing definite schizogony.”

The length varied from 3 to 8 microns and the breadth from 2 to 3 microns.

“(III) Say's Snake (*Columber melanoleucos*), from Mexico.

“The snake was very wasted, and its blood, which was very anaemic, contained a few haemogregarines. The lung was pneumonic and full of exudation; the liver was small and pale. Toxoplasmas were found in small numbers in the exudation of the lung, and in enormous numbers in the liver; a few single ones in the blood.”

The organism varied from 7 to 10 microns in length and from 3 to 6 microns in breadth. The measurements were made on fresh unfixed organisms.

In an addendum the author states that since this paper was sent for publication he has found toxoplasms in another bird, a Pied Bush Chat (*Pratincola caprata*) from India. They were found in the blood and exudation from the lungs, which were inflamed and oedematous, and in the mononuclear leucocytes as before. Further early stages of schizogony were found in the large endothelial cells in the lungs.

(g) TRYPANOSOMIASIS.

(269) BOUIN. **Trypanosomiase des dromadaires au Maroc occidental.** [Trypanosomiasis of Dromedaries in Western Morocco.]—*Rec. Méd. Vét.* 1916. Aug. & Sept. Vol. 92. Nos. 15 & 16. pp. 463–466.

In this short paper the author describes a disease which apparently has not hitherto been identified in Western Morocco, and which was found in dromedaries in the district of Marrakech.

The disease is well-known to the natives under the name of "El Debab" and is considered fatal. The symptoms presented and the microscopical characters of the causal organism lead one to believe that it is almost certainly identical with the "El Debab" described by the brothers SERGENT in Algeria. Cross immunity tests would, however, be necessary to support this conclusion.

Symptoms.—The disease runs an essentially chronic course, the symptoms being those of a slow and progressive anaemia. To commence with the affected animals show no visible symptom, the appetite being kept up and condition good. This preliminary period seems to last a long time. One of the first noticeable symptoms is lessening of the appetite and reluctance of the animal to work. The loss of appetite is gradual and the animal loses condition until it presents a markedly emaciated appearance; the coat is rough. One repeatedly notices petechiae on the conjunctiva.

The first dromedary found affected was in this condition of extreme debility. Microscopic examination of the blood showed an extraordinary number of trypanosomes. Trypanosomes were found in the case of two dromedaries out of four belonging to the same proprietor. These cases, however, did not show any sign of anaemia but had good appetites, normal mucous membranes, and well preserved condition.

These three cases were examined after an interval of five months; the latter two did not manifest any external symptom and continued at work. The first case had been sent out to grass and had become still further emaciated; this animal was about twelve years old. The other two were from five to six years old.

The author believes that this trypanosomiasis is thus a disease which runs a very slow course since a dromedary which presented serious symptoms was found after five months, interval to be in an almost identical condition and two other cases, which had been carriers of trypanosomes for at least five months, did not show any morbid symptom.

Causal agent.—The trypanosome is found by direct examination of the blood of affected animals and is very abundant during the crisis. Morphologically it resembles *T. soudanense*. When examined in the fresh state it is seen to possess pretty rapid wriggling movements, but

scarcely any translatory movements. It shows after staining a fairly short flagellum, some granules and a pretty large and distinct centrosome.

In comparison with *T. marocanum* of the horse it is as a rule longer and thinner, and its flagellum is longer. These distinctions however, are not sufficient to enable one to differentiate the two by simple microscopical examination.

Inoculation experiments were only carried out on the dog, which was found to be very sensitive. A dog thus inoculated intravenously showed a fairly large number of trypanosomes in its blood 27 hours after infection. Except for a slight loss of condition the animal was in good health five months after inoculation. Trypanosomes were revealed in the blood almost every day during the first two months; afterwards the trypanosomes appeared at longer and longer intervals and were less and less numerous. During the fourth and fifth months after inoculation they could only be found five times at intervals of from three to four days. These re-appearances always corresponded with rises of temperature. No symptom was presented except dullness during the crisis.

The author suggests that these very chronic symptoms indicate a feeble virulence of the trypanosome and hence the antiseptics hitherto employed in the case of other blood diseases might with advantage be tried.

(270) CHALMERS (A. J.) & O'FARRELL (W. R.). **Measurements of Dutton & Todd's Gambia strain of *Trypanosoma gambiense*, Dutton 1902.**—*Jl. Trop. Med. & Hyg.* 1916. Aug. 15. Vol. 19. No. 16. pp. 189-194. With 1 plate, comprising 7 figs., & 5 charts.

In 1914, with reference to the study of trypanosomes in the Khar-toum laboratories, the authors published a short note in which the following conclusion appeared:—"There being no data, that we know of, to compare these strains with *T. gambiense*, Dutton 1902, we are of the opinion that, at all events provisionally, it would be safer to keep the name *T. castellanii* Kruse 1903 for these strains until more light is thrown upon the complicated problem of: What is *Trypanosoma gambiense* Dutton 1902?"

The authors have been able to procure from TODD some of the original slides which DUTTON and himself prepared from a rat inoculated with their original strain in the course of their expedition to Senegambia, the report of which was published in 1903. The authors have taken measurements of these trypanosomes, and these would be as follows, the organisms being arranged according to BRUCE's three groups:—(1) Stumpy: 13 to 21 microns, 10.2 per cent.; (2) Intermediate: 22 to 24 microns, 28 per cent.; (3) Large: 25 microns and upwards, 61.8 per cent.

These measurements are compared with those given by (1) DUTTON for the original strain, (2) BRUCE for the Uganda strain, (3) STEPHENS and FANTHAM for the Congo strain, (4) the authors for the Lado strain, and also (5) with the strain met with in 1915 by da COSTA and others in the Island of Principe, a strain "which they stated removed itself sensibly from the classic form." The authors conclude as follows:—

"We now consider that the measurements given above afford sufficient

evidence to conclude that the causal agent of sleeping sickness in Uganda, the Congo, the Lado of the Anglo-Egyptian Sudan, Principe, and the Gambia belong to one and the same species, viz., *T. gambiense* Dutton 1902."

(271) DUKE (H. L.). **Trypanosomiasis in Northern Uganda.**—*Jl. of Hygiene*. 1916. Sept. Vol. 15. No. 3. pp. 372–387. With 1 map.

Some alarm was apparently caused by the discovery by REFORD (January 1914) in the blood of a dog, which had passed through the Masindi fly belt of Northern Uganda, of a trypanosome showing marked morphological resemblance to the human parasite, the so-called *T. rhodesiense*. Miss ROBERTSON, who had carried out a series of investigations in connection with cattle trypanosomiasis in this region in 1913 and on no single occasion found any evidence either in fly, experimental animals, or cattle of the existence of a trypanosome of the *brucei* group, expressed her agreement with REFORD's view as to the affinities of the organism to the Rhodesian trypanosome. It was thus concluded that this organism had been introduced into the fly belt during the intervening three months or so.

From a history of the movements of herds in this Province, ROBERTSON also inferred that the 10 per cent. infection of the *morsitans* throughout the fly belt, and the cattle trypanosomes infecting about 12 per cent. of stock and causing great havoc in the Buruli and Kafu country, separated from the fly belt by the Kafu river, were originally derived from the South, and had been introduced within comparatively recent years. In her fly feeding experiments mixed infections with *T. pecorum*, *T. vivax*, and *T. uniforme* were obtained and none of the flies on dissection were found to harbour the full developmental cycle of the *brucei*-like organism described by REFORD.

Duke disbelieves this view that the trypanosomes responsible for the disease in cattle, the free-flagellated *brucei*-like organism, and the infection of the fly and game of the belt are the result of a relatively recent introduction. It is inconceivable that a large area of very sparsely populated bush country thick with game and *morsitans* could remain free from trypanosomes. It is also impossible to differentiate trypanosomiasis from other diseases such as rinderpest and babesiasis by means of enquiry among the natives, the experience of the veterinary officers of the Protectorate being that the same terms might cover any of these diseases. Further, infections with such trypanosomes as *T. nanum*, *T. vivax*, and *T. uniforme* do not necessarily involve a fatal result.

The author regards the great fly belt which forms the northern limit of the Buruli-Kafu cattle country as a permanent source of all the trypanosome species found in the country and believes that infection might be carried from this belt across the Kafu River into Central Buruli either by the so-called "following fly" accompanying game or traffic, or by the passage of infected animals, game or cattle.

The author then summarises the results of the investigations which he carried out between May and September 1914 in the Masindi *morsitans* belt and in the other tsetse districts of the Northern Province in order to determine the distribution of the *brucei*-like organism. In very numerous fly feeding experiments in the Masindi belt *T. pecorum*,

*nanum*, *vivax*, and *uniforme* were frequently recovered and it was found that 0·95 per cent. of the wild *morsitans* were infected with the *brucei*-like trypanosomes. On every occasion where a positive salivary gland was seen in a fly "*T. brucei*" developed in the animal fed upon and dogs also always showed the characteristic symptom of keratitis. The blood of game shot in and around the fly belt when inoculated into clean experimental animals showed a 6·6 per cent. infection with "*T. brucei*."

In the other districts (Ngussi River, region of Tonya peninsula and shore of Lake Albert, Chopi, Victoria Nile, and Bugungu region) other species of *Glossina* were examined (*G. pallidipes*, *G. palpalis*, *G. fusca*) and similar results were obtained.

The author believes that these "facts show that a trypanosome of the *brucei* group is widely distributed throughout the southern part of the Northern Province, probably indeed whenever *G. morsitans* and *pallidipes* are found," and that "speaking generally wherever cattle are exposed to the bites of tsetse especially of the above two species, they sooner or later sicken and die out." Also, the discovery of this trypanosome showing a close affinity to the organism recently isolated from man in South Africa need not cause undue alarm.

In addition, the examination of the natives within this fly belt where the *morsitans* was shown to be infected with the *brucei* organism in the proportion of 0·5 per cent. revealed no sign of any form of trypanosomiasis, acute or chronic.

(272) VAN SACEGHEM (R.). **Contribution à l'étude de la transmission du *Trypanosoma Cazalbovi*.** [The Transmission of *Trypanosoma cazalbovi*.]—*Bull. Soc. Path. Exot.* 1916. Oct. Vol. 9. No. 8. pp. 569-573.

Trypanosomes can be divided up into three categories according to their modes of transmission:—(1) those which seem to become propagated under natural conditions, exclusively by means of *Glossina*, such as *T. brucei-pecaudi*, *congolense-dimorphon*, *rhodesiense*; (2) those which are mechanically transmitted by other species of blood sucking insects—*Tabanus*, *Haematopota*, *Stomoxys*,—such as *T. evansi*, and *T. equinum*; (3) those which are capable of being propagated indifferently by means of *Glossina* or other blood-sucking insects.

*T. cazalbovi* belongs to this third category. Its evolution in the body of the *Glossina* is quite different from that of trypanosomes restricted entirely to *Glossina*; instead of infecting the whole digestive tract it produces only a direct infection localised to the prothoscis.

The experiments of BOUFFARD and PECAUD, BOUET and ROUBAUD have demonstrated the transmission of *T. cazalbovi* by means of *Stomoxys* in the disease known as Souma, and in Erythrea and the Egyptian Soudan cases of this disease have been observed where no *Glossina* is known to exist.

The author himself has made a number of observations on the transmission of a trypanosome which he has named *T. cazalbovi* var. *pigritia* in the Zambé district. This trypanosome is chiefly distinguishable from the ordinary form of *T. cazalbovi* on account of its being less motile. In this district cases of trypanosomiasis due to the parasite have been observed in herds situated in districts where no

*Glossina* is known to exist in places in the interior of the country far away from a river, in a region which is not wooded. The first cases appear each year towards the month of November, and after the month of May no fresh cases are found. The period of danger thus coincides with the rainy season and during the dry season no fresh outbreaks occur.

It was observed that the first cases of trypanosomiasis coincided with the appearance of a *Haematopota* (*H. perturbans* Edwards), that the places where herds became infected, viz., the neighbourhood of papyrus marshes, harboured this insect and that it did not exist in places where the herds remained healthy. Trypanosomes in a living condition were also found in the intestinal tract of *H. perturbans* captured on animals infected with the above species of trypanosome. This insect is found on cattle and horses and fixes itself preferably on the belly and between the thighs, the bite being extremely painful. The author believes that this insect is the principal propagating agent of *T. cazalbowi* var. *pigritia* in the Zambesi district.

(273) VELU (H.) & EYRAUD (R.). **Trypanosomiase des chevaux du Maroc. Infestation d'un jeune chien par l'allaitement.** [Equine Trypanosomiasis in Morocco. Infection of a Milk-Sucking Pup.]—*Bull. Soc. Path. Exot.* 1916. Oct. Vol. 9. No. 8. pp. 567-568.

The author refers to the works of NATTAN-LARRIER and LANFRANCHI on the excretion of trypanosomes by means of the milk of infected females.

The following case is recorded. Five days after giving birth to three pups a bitch was infected subcutaneously with 20 cc. of the blood of a goat infected with the trypanosome affecting horses in Morocco. A rise of temperature took place on the third day after injection, and a few parasites appeared in the peripheral blood on the 14th day; they then disappeared but became very numerous again about a month afterwards, and then again for about 15 days before the animal's death, which took place on the 66th day after injection.

One pup was allowed to suck its mother, while the other two were taken away 14 days after birth; these two grew up normally. The first, however, when about two months old seemed to have become stunted in growth and dull, and then gradually became more and more emaciated. When three months old it became affected with conjunctivitis and then keratitis of the right eye. On examination of the blood a few days afterwards a few trypanosomes were found which became more and more numerous until the animal's death at the age of three and a half months.

(274) HINTZE (K.). **Versuche zur Immunisierung gegen Trypanosomeninfektion.** [Experiments on Immunisation against Trypanosomiasis.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1915. Oct. 26. Vol. 80. No. 3. pp. 377-398. With 14 tables.

The author refers to the experiments of BRAUN and TEICHMANN (1912), who first attempted to vaccinate the small laboratory animals by means of dried powdered trypanosomes and claimed to have established an immunity against subsequent trypanosome infection.

SCHILLING at about the same time claimed to have produced immunity by vaccinating with trypanosomes obtained from rats' blood and killed by means of a solution of tartar emetic (1 in 700).

The author himself has performed a number of tests, in some cases with dried trypanosomes and in others with a vaccine obtained from infected animals.

(I) *Experiments with dried nagana vaccine.*—The strain utilised for these tests was obtained from the Hamburg Tropical Institute and was carried on in white rats, in which it regularly produced death on the fourth day. Shortly before death the rat was bled and about 10 cc. of a 3 per cent. sodium citrate solution mixed with the blood. In order to obtain a firm deposit of red corpuscles a few drops of rat-blood-immune rabbit serum were added, and the overlying turbid fluid was decanted off and centrifuged. This fluid contained nearly all the trypanosomes. After centrifugation the trypanosomes collected together in a solid white film above the few remaining red blood corpuscles and they could be easily gathered by means of a capillary pipette containing a little salt solution. The trypanosomes were then placed in a small Achat mortar and dried in a Lautenschläger air apparatus, care being taken that the temperature did not exceed from 38° to 40° C. It was thus ensured that substances very sensitive to heat, such as ferments, were not destroyed. The trypanosomes were then crushed into a fine powder and used for inoculation on the same or on the next day. It was not possible to obtain more than 0.05 gramme of this material from one rat.

The vaccine was made by emulsifying this powder with a little salt solution and it was then injected intraperitoneally. Infection with virulent blood was performed by injecting subcutaneously in the back.

Tests were made on rats, guinea-pigs and rabbits; the results of these experiments are recorded in tabular form. The dose of vaccine injected, number of doses administered, and the interval between attempted immunisation and subsequent infection with virulent blood were graded in the various series of tests and control animals were utilised in each case.

In the case of rats it was found that small quantities of vaccine had no influence on the course of the disease. It was only after the employment of about 0.2 gramme of vaccine and infection after five days that the parasites appeared a few days later in the blood than in the case of the control animals and life was prolonged a few more days. Larger doses did not appear to have any greater effect and in the case of an already infected animal vaccination had no influence on the course of the disease. No animals withstood the infection.

In the case of a guinea-pig a certain amount of resistance seemed to be developed which, however, was not sufficient to prevent infection. The net result was *nil*.

LAVERAN and his co-workers maintain that the dry vaccine contains a toxin. The author found that guinea-pigs became considerably emaciated after intraperitoneal injection of the powder and before infection with virulent blood. The spleen, moreover, became enlarged as is always the case in trypanosomiasis.

Rabbits, vaccinated even with comparatively large doses of dried trypanosomes, wasted and died as in the case of control animals

although, as is invariably the case in nagana in the rabbit, the parasite could only be demonstrated by inoculation of mice.

(II) *Experiments with dried spleen pulp.*—The spleen of rats infected with nagana is always extraordinarily enlarged and numerous trypanosomes in all stages of disintegration can be found in it. Rats' spleens are very suitable for immunisation tests. In guinea-pigs the spleen is always enlarged but it varies considerably in size and weight (0.3 grammes to 13.7 grammes). In rabbits changes in the spleen are less obvious (0.6 to 4.3 grammes) and one comparatively seldom finds parasites in it.

The vaccine was prepared in the same way as the trypanosome powder by trituration and drying in an air apparatus, and then emulsified in a little salt solution.

(IIa) *Rat spleen vaccine.*—When comparatively large doses were employed guinea-pigs acquired a certain degree of immunity against the infective organisms, but this, however, only in one case was sufficiently powerful so that the animal never showed parasites in its blood and was living after nine months. Rabbits were again left quite unprotected by the vaccine.

In the case of guinea-pigs vaccinated with nagana rat spleen and infected subsequently with mal de caderas no protective action was observable.

No immunity was produced in rats.

(IIb) *Guinea-pig spleen.*—Trypanosomes appeared in the blood of a guinea-pig a few days after infection and after remaining a few days gradually disappeared and then re-appeared after a shorter or longer interval; during this interval the animal was killed and the dried spleen used as a vaccine, in some cases alone, or combined with serum in others. This treatment had apparently no effect on the course of the disease in guinea-pigs, while in the case of rats only a slight influence was observable.

(IIc) *Rabbit spleen.*—When injected either in the form of expressed fluid or in the dried form this gave no results.

(III) *Experiments with liver.*—Rat and guinea-pig liver had no visible influence.

(IV) *Experiments with guinea-pig and rabbit sera.*—Serum was obtained during the first parasite-free intervals, and experimental animals were infected at the same time or a few hours after immunisation. No influence on the course of the disease was observed even when very large doses of serum were injected when infection had already resulted.

“The conditions of trypanosome immunity are apparently very uncertain as all strains do not appear to be of the same value for producing vaccine (Schilling).”

With the strain at the author's disposal no lasting immunity could be conferred on an animal. Perhaps better results might have been obtained by the employment of larger doses. It appears that in protozoan diseases very large doses are necessary to produce any sort of immunity and the author believes that the production of such very large quantities of pure vaccine would entail enormous difficulties in practice.



- (275) HOFFMANN (G. L.). **Chemotherapeutische Studien über die intravenöse Verwendung von Antimontrioxyd bei experimentellen Trypanosomeninfektionen.** [Chemico-Therapeutical Studies on the Intravenous Administration of Antimony Trioxide in Experimental Trypanosomiasis.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1915. Aug. 18. Vol. 80. No. 2. pp. 261-279. With 6 tables.

Reference is made to the earliest use (1907) of antimony compounds, especially tartar emetic, and later of their employment in conjunction with arsenic compounds such as atoxyl.

MORGENROTH, who studied the use of a large number of antimony compounds, came to the conclusion that they had a more pronounced trypanocidal action than the arsenic compounds. Later observers also found that sodium and potassium antimony tartrates exert a specific action on *T. brucei*, causing its disappearance from the peripheral blood a few hours after injection.

A systematic study of the various antimony preparations with reference to their practical value has been made by KOLLE, HARTOCH, ROTHERMUNDT, and SCHUERMAN (see this *Bulletin*, 1914, Vol. 2. Extract 45). These authors found that only the trivalent antimony compounds possessed a pronounced trypanosomicidal action, but at the same time they exhibited a very marked toxicity. The pentavalent antimony compounds on the other hand were neither chemico-therapeutically active nor pronouncedly toxic.

An exception to the rule that trivalent compounds were markedly toxic was found in the case of the trioxide of antimony; the last named authors found that this compound was almost atoxic for mice, rats, and, to a great extent, for guinea-pigs. Comparatively small doses, however, in cases of infection with *T. brucei* led to a permanent sterilisation of the blood in experimental animals. In the chronic infections produced by *T. equiperdum* and *T. gambiense* the treatment had to be repeated in order to produce durable results. The very favourable relation between the minimum curative dose and the maximum tolerated dose demonstrated, in the case of nagana in mice, that the trioxide of antimony possessed the largest chemico-therapeutical co-efficient of all the antimony compounds.

It was found that, contrary to what was the case in mice, rats and guinea-pigs, antimony could not be administered intramuscularly in an oily suspension to other animals, especially dogs, rabbits, and monkeys, on account of the severe abscess formation it produced. In these animals the compound had thus to be administered intravenously and according to the experiments of KOLLE and his co-workers it was found that one or two injections of small doses of the trioxide in normal saline solution thus produced curative effects in nagana, as well as in dourine, in rabbits. On account of the fact that the heavy trioxide quickly precipitates in saline solution it might produce dangerous effects owing to the formation of emboli.

Hoffmann then details his own experiments on the employment of antimony trioxide. He employed as media for the suspension of the compound sterile solutions of gum arabic and of sugar. As the result of a series of experiments it was found that the best medium consisted of a mixture of both solutions: the *syrupus simplex* of the Swiss Pharmacopoeia containing 7.50 per cent. of the gum was found to be the most suitable concentration for holding the heavy trioxide in suspension.

Numerous tests on experimental rabbits showed that this suspension medium produced no toxic effects when administered intravenously in such quantities as would be employed for treatment with the trioxide.

As a rule the strength of the emulsion was calculated so that 1 cc. contained 150 mg. of  $Sb_2O_3$ . The latter was triturated in a mortar with the solutions and autoclaved ( $120^\circ C.$  for 15 minutes). Just before intravenous injection the emulsion was warmed for a couple of minutes in order to expel air bubbles.

Experiments in order to determine the toxicity when administered in this medium showed that considerably larger amounts could be tolerated than when administered in salt solution.

*Effect on rabbits infected with nagana.*—Rabbits were infected subcutaneously with nagana infected blood. When clinical symptoms had set in, as evidenced by the local lesions such as swelling of the penis and testicles, conjunctivitis, loss of hair, oedema, and swelling of the extremities, and the blood was demonstrated to be infective by mouse inoculation, varying doses of  $Sb_2O_3$  were administered intravenously. The blood was afterwards tested at various intervals by mouse inoculation. It was very clearly brought out by these experiments that even as small a dose as 23 mg. of  $Sb_2O_3$  per kilo. body weight produced a lasting cure; some of the animals were kept under observation up to eight months afterwards. The clinical symptoms disappeared almost immediately after the injection. A few animals that died in the meantime could not be said to have died from antimony poisoning as it was shown that up to 100 mg. per kilo. could be tolerated.

*Effects on dourine-infected rabbits.*—Rabbits were infected subcutaneously and, as in the preceding experiments, when about a month afterwards decided local lesions appeared, varying doses of  $Sb_2O_3$  were administered intravenously. It was found that a single intravenous injection of about 30 mg.  $Sb_2O_3$  per kilo. produced a permanent cure, as in the case of nagana. Dourine, however, owing to its chronicity is more difficult to influence.

The author thus confirms the opinions of KOLLE and his co-workers that  $Sb_2O_3$  possesses a very powerful therapeutic action as a trypanocide.

#### PARASITOLOGY.

- (276) THEILER (A.) & ROBERTSON (W.). **Investigations into the Life-History of the Wire-Worm in Ostriches.**—*Union of South Africa. Dept. of Agric. 3rd and 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 291–346. With 9 plates, comprising 22 figs.

In these investigations a detailed study was made of *Trichostrongylus douglasi* (Cobbold), which infests the proventriculus of the ostrich. This parasite causes considerable losses among young ostriches and is thus of great importance economically to the ostrich breeder. The morphological changes occurring in the larva, in its two free-living stages, and in its three parasitic stages, together with those of the adult worm are given. The bionomics of the worm are also dealt with at some length.

The influence of parasiticides and disinfectants was tested on (a) mature larvae, (b) adult worms when removed from the stomach, (c) on the worms and the mucus (stomach coat) covering the surface of the wire-worm infected stomachs, and (d) on the worm in the stomach of the ostrich. A long series of drugs were thus examined and their effect *in vitro* determined and the following drugs were tested by administration to infested ostriches:—(1) Carbolic Acid, (2) Slaked Lime and Sal Ammoniac preceded 24 hours earlier by a bottle of paraffin, (3) Thymol, (4) Beta naphthol, (5) Santonin, (6) Kamala, (7) Flores koso, (8) Liquid Ammonia, and (9) Carbon Bi-Sulphide.

It was found that "the results of the drenching experiments with drugs whose parasiticidal action is without doubt when tested *in vitro* were but slightly effective or totally ineffective when given to the bird. Although it seemed to be possible to check the laying of eggs for a short period yet only in rare cases could a permanent decrease of eggs be noted pointing to a decrease of female worms. From the description given of the habitat of the worms in the glands, under the surface of the mucus layer, such disappointing results were not unforeseen and belong to the practical knowledge of the ostrich breeder."

The following practical deductions for the rearing of ostriches free of wire-worm are drawn up:—

"(1) An ostrich, once infected with wire-worm, will remain infected for a long period, perhaps for years, and during this time it will be a constant source of infection of the pasture on which it drops its faeces.

"(2) There is as yet no treatment which with certainty will expel all wire-worms from an ostrich, and to judge from the position of the wire-worm in the glands and mucosa, it is not likely that such will be found.

"(3) Once a pasture or a run is infected with wire-worm it can remain infected for a long time, both eggs and larvae maintaining the infection.

"(4) The fresh droppings are not infective, and only become so after a while, which is shorter in hot weather and longer in cold weather.

"(5) Only the species ostrich can act as a host for the worm.

"(6) Ostriches can stand an enormous infection of wire-worm, provided they are well fed (feed both worms and birds).

"(7) Ostrich chicks do suffer from wire-worm infection even when well fed, and may succumb from larval infection, viz., before the larvae have reached the adult stage.

"(8) By means of worm-cultures made from droppings of the bird, it can be detected whether a bird is infected with wire-worm. This culture can be made in a simple way by placing the fresh droppings into a wine glass, covering it with a suitable lid to prevent evaporation of the moisture. After a few days the larvae can be seen crawling on the wall of the glass and can be recognised by the naked eye. Their number present gives an indication to what extent a bird is infected.

"From these notes it must be concluded:—

"(1) That wherever ostriches have been running the pasture is infected, and wherever the pasture is infected the birds will be so too.

"(2) It is accordingly not advisable to rear young ostriches on ground where old ostriches have been running and feeding.

"(3) In the case of old infected ostriches but little can be done except to dose them with drugs as hitherto applied (carbolic acid, slaked lime, sal-ammoniac, etc.). Good feeding is essential.

"(4) On ostrich farms where clean ground is no longer available, clean runs for young birds can be prepared and the birds can be reared in such runs until they have reached the age when wire-worms are no longer so dangerous to the birds. The cleaning of the run is best carried out by removing the surface of the ground to the depth of about three inches. Use can be made of disinfectant, but this is less certain.

"(5) The chicks must then be fed with the usual foodstuffs grown on land over which no birds have been running.

"(6) The runs of the chicks must be so placed that infected birds do not come in contact with them, and no flooding takes place.

"(7) These runs must be stocked with chicks reared in an incubator, or chicks removed from the nest immediately after hatching.

"(8) When hens and chicks are kept together, it would be advisable to clean the runs at least every 48 hours (better every 24 hours), by picking up all faeces of the adult birds, which is best done by daily changing the birds from one run to another, whilst the one is cleaned.

"(9) For the purpose of rearing ostriches no large paddocks are required, small runs will be sufficient. We found a run of 100 by 50 feet quite sufficient and successful.

"(10) Chicks reared in this way will also be free of other intestinal worms (Sclerostomum and Tapeworm).

"(11) An effective control can be carried out by means of the glass cultures as described above."

A series of experiments was performed to show that the suggestions enumerated above could be carried out in practice.

(277) VEGLIA (F.). **Anatomy and Life-History of the *Haemonchus Contortus* (Rud.).—Union of South Africa. Dept. of Agric. 3rd and 4th Reports of the Director of Veterinary Research. 1915. Nov. pp. 347–500. With 23 plates, comprising 60 figs., and 18 charts.**

In this very long article the author details the results of experimental work commenced in 1911 at the instigation of Sir Arnold THEILER, the Director of Veterinary Research for the Union of South Africa, with the object of obtaining accurate data on which a scientific prophylactic treatment for haemonchosis in sheep could be based.

The enormous economic losses caused by this worm are, of course, well known in most parts of the world; hence the author was well justified in devoting such a large amount of patient research to the anatomy, morphology, and cycle of development of the worm. This article, and more especially the parts dealing with the bionomics of the parasite, has been pretty fully extracted in the *Journal of Comparative Pathology and Therapeutics*, 1916, Sept. Vol. 29. Part 3. pp. 265–277. It is felt that insufficient justice could be done to this work by an extract of the length usually inserted in this *Bulletin*.

The work represents probably one of the best studies in veterinary helminthology that has yet been published. A very large part of the work is devoted to anatomical and morphological details, but the chapters dealing with the influence of the environment on the eggs and larvae, migration of the mature larvae, and the parasitic life of the larva and adult worm provide very instructive reading.

(278) BULL (L. B.). **Granulomatous Affection of the Horse—Habronemic Granulomata (Cutaneous Habronemiasis of Railliet).—Jl. Comp. Path. & Therap. 1916. Sept. 30. Vol. 29. No. 3. pp. 187–199. With 5 figs.**

In this article the author describes tumours which affect the glans penis and sheath of the horse in the northern parts of Victoria and South Australia, and probably elsewhere in Australia. They are first met with during the summer and autumn months. In two cases lesions affecting the metacarpal and hock region as well were observed.

The tumours appear suddenly, are of a tough fibromatous nature, and vary in size from that of a pea to that of a walnut when found on the glans penis, and are considerably larger (up to 6.5 cm. in diameter) when seen on the sheath. They are usually ulcerated on the surface. On section small caseous and sometimes calcareous areas are found scattered throughout the dense fibrous mass. A layer of dense fibrous tissue covered the growth found in the metacarpal region.

On microscopical examination the appearances are found to vary with the age of the lesion and in the older lesion it is very difficult to demonstrate the causal organism. Beneath the ulcerated granulating surface one finds hyperplasia of the fixed connective tissue cells together with a marked eosinophile infiltration. In this mass may be found circular areas consisting of embryonic connective tissue cells, with few or no eosinophiles, and also caseous areas surrounded by a zone of reaction composed of epithelioid cells together with some multinucleated cells. A calcareous deposit may sometimes be seen in the areas. In the centre of these necrotic or caseous areas may be seen circular or ovoid spaces, at one time occupied by a larval nematode. In the earlier lesions the distinct form of the parasite is seen in the shape of the homogeneous finely ridged cuticle, the underlying musculature, and the primitive alimentary canal.

All the parasites were apparently dead but the retrogressive processes varied considerably in extent. The debris found in the spaces in necrotic areas is no doubt that of a nematode parasite. In the older lesions one may be unable to detect any degenerate parasites or even the spaces which the parasite at one time occupied.

The tissue reaction is far more marked and the necrotic areas are more diffusely scattered in lesions from the sheath than from the penis. The lesion from the metacarpus varied in that there was little formation of new tissue apart from the areas of hyperplastic connective tissue cells and some thickening of the dense subcutaneous connective tissue.

*The parasite.*—The author was only enabled to examine preserved specimens about four weeks old and hence the parasite was always dead. Specimens separated from the tissue measured approximately 3 mm. long by 40 to 50 $\mu$  broad. The anterior extremity tapered slightly towards the head, which was rounded; mouth was surrounded by thin prominent lips; posterior extremity terminated at the tip to form a small bulb furnished with minute spines.

The parasite thus appeared to be an immature nematode closely resembling the sixth larval stage of *Habronema muscae* as found by RANSOM in *Musca domestica*. The mode of entry of these parasites is not known but there seems no doubt that they are accidental and have no power of completing their life history. Their remarkable predilection for the region of the penis and sheath is probably explained by the fact that some biting insects (e.g., *Stomoxys calcitrans*) are known to favour these regions.

No other organisms besides these nematodes were ever found in the lesions. The tumour gradually enlarges and may exist for an indefinite time, although the parasites die out in about four weeks time.

The author refers at length to RAILLIET and DESCAZEAUX's views on a similar condition—*Esponja*—found in equines in Brazil [see this *Bulletin*, Vol. 4, No. 3, Extract No. 185], and he considers that the

lesions he describes in this article are of the same nature. It is stated that RAILLIET erred in his anxiety to include all recorded cases under the same head, as the parasites described by other observers in no way resemble stage 6 of *H. muscae*. Also, if the larval nematodes are able to penetrate the skin, as suggested by RAILLIET, it is difficult to explain why so many appear at the same point, as each tumour contains many parasites.

Reference is made to the work of HARVEY JOHNSON who found larval Habronema in *Stomoxys calcitrans* and *Musca domestica*, and a similar form in the cattle fly *M. vetustissima* in Queensland; the author believes that this still further strengthens his contention that the larvae are introduced by biting flies.

*Swamp Cancer*.—The author has examined histologically sections from the equine granulomata occurring in the Northern Territory of Australia and found that they present the same picture as those of an old habronemic lesion as described above. He thus believes that Swamp Cancer is almost certainly a variation of the same condition.

*Prophylaxis and treatment*. This should be in the direction of:—(1) ridding horses of the adult forms of the genus Habronema which are located in the stomach; (2) destruction of faeces which bear the embryos and which act as a breeding ground for flies; (3) complete excision of the lesion before it has become inoperable is the only treatment to be advised.

(279) JOYEUX (Ch.). *Sur le cycle évolutif de quelques Cestodes. Note préliminaire*. [Life Cycle of Some Cestodes. Preliminary Note.] —*Bull. Soc. Path. Exot.* 1916. Oct. Vol. 9. No. 8. pp. 578–583.

The following tapeworms are dealt with:—(1) *Dipylidium caninum* (L.). (2) *Hymenolepis diminuta* (Rud.), and (3) *Hymenolepis nana* v. Siebold.

In the case of the first of these tapeworms the author has attempted to solve the problem how the rat-louse and rat-flea could become infected with the eggs of Dipylidium in view of the fact that the proboscis of these insects appears too small to allow of the passage of an egg. Infection of the insect was found to take place in the larval stage when the mouth parts are large enough to admit the cestode egg, and the cycle of development in the larva and adult insect was followed.

In the case of the second cestode, affecting the rat and sometimes man, the life-cycle in various insects, including the caterpillar and butterfly, was followed.

The third parasite, affecting man, and most probably it is the same species which affects the rat, is capable of undergoing its complete life-cycle in one host.

(280) VELU. *Note sur une lesion de Myase intestinale chez le cheval*. [A Lesion due to Intestinal Myiasis in the Horse.]—*Rec. Méd. Vét.* 1916. July 15. pp. 408–410. With 2 figs.

Velu records a case in which tumours were formed in the sub-mucous connective tissue of the duodenum of a horse due to larvae of the species *Gastrophilus veterinus*. These tumours were similar to those caused by *Spiroptera megastoma* in the stomach; two were of about the size of a walnut and the other one about the size of a large egg.

They formed only a slight swelling in the lumen of the intestine and the mucous membrane remained in the same condition as that of the surrounding parts. On section these tumours were seen to be composed of dense fibrous tissue containing a number of inter-communicating small cavities filled with a greyish-white purulent material containing the bots. The channels communicated with the lumen of the intestine by means of very small orifices.

Bots were extremely frequent in Morocco in 1913 owing to the abnormally long dry season, but, as elsewhere, they hardly ever caused any serious symptoms.

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#### MYCOLOGY.

(281) CAZALBOU (L.). **La Culture Naturelle des Champignons Pathogènes.** [Natural Cultivation of Pathogenic Moulds.]—*Rev. Gén. Méd. Vét.* 1916. Sept. 15. Vol. 25. No. 297. pp. 410-421. With 11 text figs.

The author believes that the advances made in the last few years in the study of the mycology of pathogenic vegetable organisms lead one to consider the microbe as representing, in the living tissues of the affected animal, the degraded form of a mould whose normal evolution must take place in external media. The author then gives a summary of the results of a number of publications he has already made on this subject.

The present work has as its object, by means of a few examples, to make the author's conception more comprehensible, and to point out the primary laws which seem to govern mycoculture. These examples are chosen from among: (A) Dermatophytes (*Trichophyton faviformes*, *Tr. equinum*, *Achorion annulosum*, *A. serisei*, *Microsporion equinum*; (B) Bacillary Bacteriaceae (tubercle bacillus); (C) Yeasts (Rivolta's Cryptococcus); (D) Cocco-bacteriaceae (mycetomic coccus of the horse).

Brief descriptions, together with diagrams, illustrating the development of each of the above organisms in artificial culture and in natural culture are given. The following are the author's conclusions:—

"(1) Transplanted directly into cell-culture, in natural conditions of development the organism uses up all the medium in the formation of its vegetable system: (hyphae and special reserves).

"(2) It is only after the complete utilisation of the medium that the mould which has thus satisfied the needs of the individual element inclines towards the formation of organs of preservation (conidia) and of reproduction (true spores).

"It is for this reason that the dermatophytes, even those which grow best in test media, do not grow beyond the vegetative stage.

"(3) The development of a "chlamydosporic" hypha seems to indicate that the appropriate medium has not yet been discovered."

(282) MEYER (K. F.) **The Relation of Animal to Human Sporotrichosis. Studies on American Sporotrichosis III.**—*Jl. Amer. Méd. Assoc.* 1915. Aug. 14. Vol. 65. pp. 579-585. With 1 table and 1 map.

In this article the author describes the distribution and spread of sporotrichosis in animals in the United States since 1909 when PAGE,

FROTHINGHAM, and PAIGE described their finding of sporotricha in the pus which had been collected from the abscesses of so-called cases of "epizootic lymphangitis." The epizootiology of the disease is dealt with especially with regard to the possibility of its transmission to man. A review of recorded cases is given and also the detailed history of a laboratory infection, apparently of the author himself, following on manipulation of large quantities of cultures of equine sporotrichosis. The following are the author's conclusions:—

"Spontaneous sporotrichosis of domesticated animals, particularly horses, is very common in certain parts of the United States.

"Extensive bacteriological and serologic experiments have proved the identity of the causative organisms in human and animal sporotrichosis. The pathogenicity for human beings was observed in an accidental laboratory infection.

"The geographic distribution of equine sporotrichosis, which is apparently closely connected with certain telluric and climatic conditions, covers, in two states, the same territories from which numerous cases of human infection have been reported in the last five years. In Pennsylvania, equine sporotrichosis—as so-called "epizootic lymphangitis"—has been noted in as many as 150 cases annually.

"Only two human cases are on record in that state. A careful study of one case suggested at first a contact infection with a sporotrichotic horse, but this assumption could not be proved conclusively. The evidence collected does not support the theory that human sporotrichosis is very frequently transmitted from horse to man in the United States. The cases of Hyde and Davis, Sutton and others are discussed from this point of view, and compared with the cases reported by Gougerot, Carougeau, Lutz and Splendore, and Rouslacroix.

"The absence of sporotrichosis among veterinarians and farmers in Pennsylvania—where equine sporotrichosis is so exceedingly common and so often treated, calling forth undoubtedly close contact with infectious material—demonstrates that sporotrichotic infections in man are established by this channel of contact in rare instances only."

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## BACTERIAL DISEASE.

### UNDULANT FEVER.

- (283) IZAR (G.). **Studi sull' infezione spontanea da micrococco di Bruce negli animali domestici. Nota I.** [Studies on Spontaneous Infections with Bruce's Micrococcus in the Domesticated Animals. Note I.]—*Sperimentale*. 1916. June 9. Vol. 70. No. 2. pp. 137-158. With 5 tables and 1 text fig.

As the result of a resolution passed by the eighth meeting of the Italian Pathological Society urging the immediate adoption of rational prophylactic measures against Malta fever, a Commission was appointed in 1913, with the support of the Italian Government, by the Commune of Catania. The author was entrusted with the directorship of the Pathological and Chémico-Physiological Section.

The author first details the history of the discovery of Malta fever in the blood and milk of goats since ZAMMIT's original observations, and the striking results obtained at Malta, in accordance with instructions drawn up by the English Royal Commission, and elsewhere by direct prophylactic measures against the infected animals.]



Attention is drawn to the experiments of ROSS, HORROCKS and others, in which the milk of goats that was certainly infected failed to transmit the disease to monkeys or man, and Ross's observations on a regiment in which a greater number of cases of infection was observed in men partaking of boiled milk than in another regiment in which unboiled milk was used. These apparent discrepancies have been explained as being probably due to the action of the gastric juice on the micro-organism.

The plan of campaign adopted by the author with the approval of the Commission as regards sero-bacteriological investigations among milk-producing animals was as follows:—

(1) From every milk-producing animal (goats, cows, asses, sheep) a sample of blood was to be taken from the auricular vein and a specimen of milk in sterilised receptacles, duly sealed and sent to the Institute for examination; at the same time a special mark was to be placed on the animal.

(2) Animals whose blood gave positive agglutinations in dilutions of over 1 per cent. and whose milk had the same properties in dilutions of over 10 per cent. were to be isolated in a suitable place and subjected to final examinations (cultural tests of the blood, milk, urine, etc.) in order to diagnose the existence of active infection.

(3) Animals thus found actively infected were to be slaughtered or utilised for final studies, compensation being given to the owners. When on the other hand successive examinations, repeatedly made, gave no positive result the suspected animal was to be restored to its owner a month after its isolation.

(4) If at least one-third of the animals in a herd gave positive milk or serum reactions the whole herd was to be isolated and subjected to final examinations.

Difficulty was found in numbering and identifying a large number of animals according to the above plan. (In Catania there are about 14,000 goats.)

As to the importance of the serum reaction the author recalls the results obtained by HORROCKS and KENNEDY, who examined the milk and the blood of 86 goats with the following results: In 42 goats, positive serum and milk reaction; in 16 goats, positive serum reaction and negative milk reaction; in 28 goats negative serum and milk reactions. In no case was a positive milk reaction and a negative serum reaction obtained, thus demonstrating that by the milk reaction about 28 per cent. of infected animals escape recognition.

Difficulty was experienced in obtaining milk from all milk-producing animals on account of some having become pregnant or having recently given birth to young. In practice it was found impossible to obtain milk from such animals directly their milk was being used for human consumption. The error might thus be over 28 per cent. The author thus temporarily modified his original programme restricting it to a work of preparation by gathering data to demonstrate the importance of a systematic examination of milk-producing animals. Milk was thus taken by employees under the control of the civil police from such goats as the owners chose to assign to them. The results have thus only a relative value because a good many animals suspected by the

owners did not figure in the tests and because by the mere examination of the milk about 28 per cent. must escape recognition according to the data of HORROCKS and KENNEDY.

*Technique.* The author examined the various methods proposed for the examination of the milk before commencing his own researches and found that for clearness of result and rapidity in reading the best method of working was with milk serum.

In dealing with numerous specimens of milk a modification of PULVIRENTI'S method was found to be preferable. After acidification (by the addition of six to eight drops of acetic acid to 15 cc. of milk) the mixture was kept for two hours at 37 ° C. and, after shaking, it was centrifuged for a long time. With a small narrow pipette the few tenths of a cc. of the clear serum required for the test are taken out and made up into various dilutions at 1/10, 1/20, 1/40, 1/80. To these dilutions is added an equal number of drops of a thick emulsion of Bruce's micrococcus in normal saline solution obtained by suspending the 48-hour surface agar growth in 3 cc. of normal saline solution. After shaking, the small tubes were left in the incubator for five hours.

The author, using milk serum, considers that an agglutination at 1/10 indicates a positive reaction. Numerous cases of positive reactions up to 1/40 were observed; less numerous cases of positive agglutination up to 1/80, and exceptionally those with still higher values. The only cow found to be infected gave a complete agglutination at a dilution of 1/640. It is important to control the organism from time to time as changes in specific agglutinability may occur in it after being kept in the laboratory. Paradoxical results are also sometimes obtained.

The author next quotes a series of very interesting statistics published by various observers on the occurrence of the infection in various countries in different animals, such as goats, mules, horses, donkeys, cattle, pigs, cats, rabbits, guinea-pigs, sewer rats, fowls, and camels.

The milk-producing animals examined by the author were 1,289, of which 1,253 were goats and 36, cows. Of these 149 goats and 1 cow gave a positive milk reaction, i.e., 11·8 per cent. of the goats examined and 2·7 per cent. of the cows examined which, increased by 18·6 per cent. in the case of the goats, gives a total of 30·4 per cent. of suspected animals.

Tables are given showing the results of tests of animals selected from various herds and the percentage of infected animals in each herd. The author believes that these percentages do not appear extraordinarily high considering the facilities afforded to the goats of infecting each other and also the fact that as a rule the disease develops insidiously without producing any rapid or notable weakening or sudden death of the animals.

The topography of a centre of infection, illustrated with the aid of a diagrammatic plan of an affected area, shows that the disease is closely connected with direct contagion from individual to individual and from herd to herd. From this plan it is seen that in one group of streets the infection almost exclusively struck those herds whose pens were situated at one end of a certain main street and extended into the neighbouring side streets, whilst the herds penned in the neighbourhood of the other end of the main street remained unaffected. Between the two inhabited ends of this main street there intervened a fairly

large uninhabited zone of rocky ground which apparently prevented or delayed the spread of infection from one end of the street to the other.

This simple illustration demonstrates the prophylactic importance of a timely discovery of the first cases of infection in a herd in order to avoid the propagation of the disease amongst all the goats in the herd and amongst the goats penned in the vicinity. The same principle applies to germ carriers, i.e., one should remove and isolate the carrier animals before the infection breaks out and if it has already broken out both carriers and infected should be removed.

In the course of a year the bloods of 268 dogs, 825 oxen, and 35 goats brought for slaughter were examined; 0·7 per cent. of the dogs, 0·12 per cent. of the oxen, and 8·5 per cent. of the goats gave positive reactions. The majority of the cattle, however, were imported from Serbia and Bulgaria where Malta fever is not known to exist, and not from the Sicilian countryside.

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## DISEASES DUE TO ULTRAVIOLET VIRUSES.

### (a) FOOT AND MOUTH DISEASE.

(284) TERNI (C.). *Ricerche ed esperienze per lo studio della immunità all' afta.* [Immunity against Foot-and-Mouth Disease.]—*Clinica Vet.* 1916. May 15. Vol. 39. No. 9. pp. 257-261.

The conclusions drawn by Cosco and AGUZZI in their preliminary note [see this *Bulletin*, Vol. 4, No. 2, Extract No. 115] correspond with the results of a series of observations made by the author while carrying out investigations under the direction of the "Italian Commission for the Study of Immunity against Foot-and-mouth Disease." The following are his conclusions:—

(1) The virus of foot-and-mouth disease can be preserved indefinitely by 'passage' in series through susceptible animals, either with blood products (serum or red corpuscles) or with the products of local lesions. The best method of preserving the virulence for controlling the activity is *lingual inoculation*, either with blood taken when the temperature rises above 40° C. or with the products of the local lesions. The maximum virulence is obtained with the epithelium of the digestive tract (tongue, rumen).

"(2) The 'passage' or fixed virus is obtainable with its maximum infectivity, virulence, and power of diffusion after 24 to 36 hours. It almost invariably kills young animals (calves, lambs, kids, sucking pigs) by a generalised infection with constant presence of the virus in the blood.

"(3) Experiments now undertaken seem to show that other species of animals can maintain the virus in a virulent state for a variable time without manifesting apparent external lesions.

"(4) It is possible by inoculation of the products of blood stored in the incubator or in the cold until the virulence has disappeared to obtain in animals a resistance capable of withstanding direct inoculation of the virus or infection by cohabitation with animals affected with acute forms of the disease.

"(5) The serum of bovines that have passed over the febrile period of the disease has a notable preventive and curative power against the virus of foot-and-mouth disease, even of a malignant nature. The inoculation of whole blood or of serum preserves adult animals with certainty from death and promotes a rapid cure.

“(6) Two forms of immunity can be distinguished: the one is general and resides in the blood, and the other is of a more strictly histogenetic nature and is related to the epithelia protecting the digestive tract. The latter is more fragile than that of the blood and is strictly relative to the regeneration of the epithelial cells. In bovines as the result of lingual inoculation one observes a gradual loss of immunity, at first of the lingual epithelium, then of the rumen and small intestine, and then of the tissues of the coronary band. This is why it is that in natural conditions one may see animals affected with serious natural manifestations, especially of the lingual epithelium, without the passage of the virus into the blood, because there still persists a sufficient degree of immunity to protect the animal from a general infection, or because the virus only penetrates for a very short time and in an attenuated condition. These are the cases in which the febrile reaction is insignificant or entirely absent.

“The clinical forms of the disease (external, internal or malignant) are in direct relation to the degree of immunity existing in the tissues and in the blood. In an animal which has never been infected or has completely lost its immunity the smallest lesion of the buccal epithelium or of the rumen allows of the establishment of a primary centre of infection, which in a few hours afterwards provokes an infection of the blood as shown by the access of fever. When, on the other hand, as frequently happens after the first attack, there still persists in the blood a certain degree of immunity the centre of infection involving one or several points on the epithelium of the anterior digestive tract remains localised; but, the virus can acquire even by this first passage an increase of infectivity for other susceptible animals.

“(7) On the contrary in order to procure a malignant strain of virus, that is to say, one which has the maximum infective and diffusive power, it is preferable to associate the blood products with material from local lesions and thus utilise the substance elaborated in the predilection seats to obtain an increase of local histogenetic immunity. This prevents with certainty and for long duration the external lesions, which have serious consequences for the affected animals and cause widespread diffusion of the virus.

“(8) In the case of adult animals that have died from the apoplectic form after a prolonged interval the virus may be altogether absent from the blood but can be found localised in different organs, especially in the cardiac muscle, brain, liver, kidneys and even in the spleen and bone marrow. In the blood the maximum virulence is found in the portal veins. The elimination of the virus from the blood takes place for the most part by means of the kidneys and to a smaller extent by the milk and the saliva, which only becomes infective in the majority of cases as the result of local lesions.”

#### (b) FOWL PLAGUE.

(285) BELFANTI (S.) & ASCOLI (A.). *Spigolature nella Peste Aviaria e nell' Afta.* [Notes on Fowl Plague and Foot-and-Mouth Disease.]—*Clinica Vet.* 1916. Oct. 15. Vol. 39. No. 19. pp. 577-597. With 5 tables & 2 charts.

*Fowl Plague.*—Some preliminary experiments were conducted on fowl plague with the object of obtaining some useful information on foot-and-mouth disease, especially with regard to immunity against it.

Reference is made to the works of LANDSTEINER, who showed that the virus in fowl plague was largely localised in the red blood corpuscles of affected animals. MAGGIORA and VALENTI, in the case of young geese in which the disease runs a less rapid course and presents a nervous form, showed that the virus which is at first localised in the blood disappears from it later to establish itself in the central nervous system; this is on a parallel with the virus of foot-and-mouth disease which, according to COSCO and AGUZZI, is present in the blood during

the febrile period but during the eruptive stage disappears from it and is only found in the local lesions, on the mouth or feet. KLEINE and MOELLERS, by daily examination of the blood of infected young geese, confirmed these statements but found that in a few cases the virus re-appeared in the blood shortly before death, i.e., in from five to seven days.

The authors' experiments were all made on fowls; the virulence of the blood *in toto* was tested as well as the virulence of its various constituents, that is to say, of the red corpuscles, of the serum, and of the leucocytes. Some tests were concerned with the virulence of the brain and a special series dealt with the waters of centrifugation of the blood. The results of these experiments are recorded on the tables. It was noted that all produced fatal results in from 12 to 108 hours. The enormous virulence of the red blood corpuscles was evidenced in that a dose of 1 cc. was capable of producing death even when diluted  $5^{15}$  times (that is, with an actual dose of 0.0000000016384 cc.). This high virulence had previously been pointed out by LANDSTEINER, MAGGIORA and RUSS.

The waters of centrifugation also proved extraordinarily virulent, even up to the thirtieth washing, the highest one tried, although care was taken that they contained no corpuscular elements.

The authors believe that this last phenomenon may be due to the fact that a small quantity of the micro-organism remains in suspension in the medium after each washing. They also believe that the alleged success claimed by MARCHOUX in the cultivation of the virus in 2% glucose agar containing 1% peptone could be attributed to the same facts, even though he claimed that his cultures were virulent after 10 passages. These cultural experiments were repeated by the authors, but no multiplication of the virus could be demonstrated by means of Gosio's telluritic indicator. Similarly negative results were obtained in Noguchi's medium. The theory of MROWKA and SANFELICE suggesting that the virus might in reality be a matter of protein grouping, such as globulins, is recalled.

A fair number of experiments were devoted to attempts to immunise fowls against fowl plague, the material used being infected blood, brain, and liver. An attempt to vaccinate with red corpuscles suitably diluted failed, and then vaccination with virus killed by ether was tried, as suggested by SCLAVO, used by VINCENT for the preparation of typhoid vaccine, and recently employed by CAMUS and FORNET for the purification of Jennerian vaccine. The results of a single vaccination were indecisive but appreciable effects were obtained with two vaccinations, in that death took place with a quite noteworthy delay as compared with the controls.

*Foot-and-mouth Disease.*—The authors' experiments on this subject were rather limited, and were confined to attempts at the immunisation of pigs.

Attempts at cultivation of the virus proved negative.

Serum obtained from LOEFFLER, even when administered in large doses (50 to 60 cc. per head), proved quite ineffective.

As a result of their experiments on pigs inoculated intravenously with virus of bovine origin the authors concluded that, as regards immunisation, what happened was in no way analogous to the results obtained in the fowl plague experiments. The only positive results were

obtained in cases where blood or washed red blood corpuscles preserved at ordinary temperature or in the incubator were employed. The foot-and-mouth disease virus did not seem to be in any way affected by the action of ether, as it preserved its infectivity almost unaltered.

With regard to the apparent immunising effect of blood in their experiments, the authors refer to the successes obtained by DEL BONO, PERRONCITO, and TABUSSO in a large outbreak in 1901, in which the curative and preventive effect of blood inoculation was very marked.

(286) COMINOTTI (L.). **Peste aviaria nella anitre.** [Fowl Plague in Ducks.]—*Clinica Vet.* 1916. Mar. 15. Vol. 39. No. 5. pp. 129–135. With 2 figs.

The author studied an outbreak of fowl plague among the ducks on the lake of the Public Gardens of Milan; 50 per cent. of the birds became affected. A brief survey of the literature connected with the subject is given. The following are the author's conclusions:—

“(1) Fowl plague may attack wild ducks placed in the same conditions as domesticated birds.

“(2) The clinical form in which the disease manifests itself in these animals is the nervous form.

“(3) The morbid anatomy of the disease shows nothing characteristic.

“(4) The virus cannot be found in the blood or in the internal organs, even when quantities exceeding those employed in working with the disease in geese are used. It is found, however, in the central nervous system.

“(5) The transmission of the infection to fowls is possible by means of subcutaneous injection of emulsions of the cerebral substance of infected ducks; on the contrary it is not possible to transmit it to the domesticated duck, however large a dose of virus is employed, either by ingestion, intravenous inoculation, instillation on to the conjunctiva, or even by intracerebral inoculation.”

#### (c) VARIOLAE.

(287) AMAND & HUON. **Asino-vaccin.** [Ass-Vaccine.]—*Bull. Acad. Méd.* 1916. July 25. (Report extracted in *Rev. Gén. Méd. Vét.* 1916. Sept. 15. Vol. 25. No. 297. pp. 443–444.)

“Since 1906, Amand and Huon have tried to utilise vaccine from the ass in order to regenerate the activity of vaccinal pulps. The ass vaccine, used as seed material, gives on the calf very remarkable cultures of vaccinia while at the same time it confers quite a special activity upon the virus; moreover, ass vaccine utilised in public vaccinations gives vaccinal reactions in cases where the bovo-vaccine remains powerless.

“Their practice extending over several years at Marseilles, that is to say, thousands of observations, have confirmed all these data and demonstrated better than could any discussion the remarkable activity of the ass vaccine; at the same time all these observations have given proof of the complete absence of accidents when one uses it on a large scale for human vaccination.”

(288) WURTZ (R.) & HUON (E.). **La variolisation des génisses immunisées contre la vaccine.** [Variolisation of Calves immunised against Vaccinia.]—*C. R. Acad. Sci.* 1916. Sept. 18. (Report extracted in *Rev. Gén. Méd. Vét.* 1916. Oct. 15. Vol. 25. No. 298. p. 490.)

“It is known that the vaccination of calves with the Jenner vaccine confers upon them after a relatively short space of time a lasting immunity. The precise and repeated experiments of Kelsch, Camus, and Tanon have shown that immunity is always acquired on the eighth day.

“With these facts in mind, the authors, by inoculating a variola into calves vaccinated eight days beforehand with the Jenner vaccine, produced in them the variola.

“Proof that it is in reality a variolar eruption is furnished by the clinical course of the disease and the appearance of the eruption, by the morbid anatomy of the eruptive elements, and the results following their inoculation into the monkey and the rabbit.

“It appears strange that the Jenner virus after having immunised the body fluids against vaccinia sensitises these fluids on the contrary against variola, but this occurs for a very short time only.

“It seems legitimate to deduct from these experiments that variola and vaccinia are due to two totally different organisms.

“The serum of animals thus variolised has given very promising results, when used in the case of the monkey and the human subject, from the point of view of treatment of variola.”

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#### MISCELLANEOUS DISEASES.

- (289) MITCHELL (D. T.). **Investigations into Jagziekte or Chronic Catarrhal-Pneumonia of Sheep.**—*Union of South Africa. Dept. of Agric. 3rd and 4th Repts. of the Director of Veterinary Research.* 1915. Nov. pp. 583-614. With 4 tables and 2 plates comprising 8 figs.

The above disease affects sheep in various districts in the Cape Province, Free State and Transvaal. It has previously been investigated by HUTCHEON, and ROBERTSON (1904).

The symptoms shown are briefly those of gradually progressing respiratory distress—giving the animal the appearance of having been driven, hence the Dutch name Jagziekte (*jagt*, to drive; and *ziekte*, a sickness)—a mucous discharge from the nostril, coughing, debility, anaemia, and sometimes loss of patches of wool and diarrhoea. Cases usually occur singly, and outbreaks involving a large number of sheep in the same flock are unknown. The animals attacked are generally about three years old; no cases have been noted to occur among lambs. Young sheep in good condition do not usually become infected under natural conditions, but no difference in susceptibility due to age or condition could be observed among the experimental animals. Statistics from the infected areas show an average mortality of 1.6 per cent. per annum. The disease is invariably fatal.

The disease has to be differentiated from the caseous lymphadenitis of NOCARD, and a condition sometimes produced by extensive infection of the lungs with cysts of the *Taenia echinococcus*.

The author has devoted a considerable amount of attention to a study of the morbid anatomy and histology of the disease. Briefly the lesions consist of a patchy or lobular pneumonia; each lesion in the lung varies from the size of a haricot bean upwards and on closer examination is seen to be composed of small greyish translucent nodules, each about the size of a millet seed. There is also a pleurisy with the formation of fibrous adhesions overlying the affected parts of the lung.

The presence of these nodules of a lymphoid nature in the pneumonic area is stated to be characteristic. The nodules may develop in connection with the bronchi or in the inter-alveolar connective tissue.

The other changes in the lung tissue are those of a broncho-pneumonia, viz., exudation of catarrhal products into the alveoli, and later, fibroid changes, bronchitis, and peri-bronchitis. As the disease progresses the lesion becomes hard and dense, almost cartilaginous in consistence. Lesions of emphysema and atelectasis occur in the healthy lung tissue at some distance away from the main lesion and pleurisy is constantly present. Sometimes abscess formation in the lungs, due to the presence of the Nocard-Preiz bacillus, was noted.

The period of incubation is difficult to determine but from the author's experiments it was deduced that lesions might be found in in-contacts in from three to five days.

*Experimental work.*—A series of experiments was performed in which various products from the affected animals, such as emulsions of glands, blood, bronchial mucus, and of lung lesions were administered to healthy sheep by drenching, or inoculation subcutaneously, intravenously or intratracheally. Altogether 72 sheep were treated in this way and the results in all cases were negative except in the case of one sheep. This sheep had been used in three other experiments and it was concluded that the infection was accidental.

Experiments were next performed to ascertain if infected sheep when placed in contact with healthy animals were capable of transmitting the infection, and, if so, in what time lesions of jagziekte became evident. Infected and healthy sheep were thus kept together in four loose boxes and slaughter of in-contacts from each box was carried out at intervals of two, eight, and ten days respectively and a careful post-mortem examination made in each case. Two animals which had been eight days, and one which had been ten days in contact were found to have lesions in the lungs. It was thus concluded that the disease is capable of being transmitted from infected to healthy sheep by immediate contact, and that it is possible that macroscopic lesions could be detected after a period of about five days in contact.

A further experiment was performed in order to ascertain whether a loose box in which affected animals had been kept for some time was capable of conveying the infection to healthy sheep. It was found that two sheep out of 10 kept in an infected box contracted the disease, the first case being observed in a sheep which had been 10 days in contact and the second case in one which had been 30 days in contact.

This proves that the contagion is fixed and persists in a form capable of communicating the disease for some time after infected animals are removed.

Conditions of transmission thus point to a specific virus being the cause. No parasites could, however, be found in the lesions and microscopic and cultural examinations for the presence of organisms have hitherto been negative.



(290) MORI (N.). **Esistenza della pleuropolmonite essudativa delle capre nell' Italia, centrale e meridionale.** [The Existence of Exudative Pleuro-Pneumonia in Goats in Central and Southern Italy.]—*Nuovo Ercolani*. 1916. Jan. 31. Vol. 21. No. 3. pp. 37-41.

——. **Sulla etiologia e sulla profilassi specifica della pleuropolmonite essudativa delle capre.** [Etiology and Special Prophylaxis of Exudative Pleuro-Pneumonia of Goats.]—*Ibid.* April 30; May 10 and 20. Nos. 12, 13, 14. pp. 196-198; 205-211, and 221-228.

——. **Natura ifomicetica dei corpuscoli della pleuropolmonite essudativa delle capre. Il germe specifico della malattia e' un aspergillo.** [Hyphomycetic Nature of the Corpuscles in Exudative Pleuro-Pneumonia of Goats. The Specific Organism of the Disease is an Aspergillus.]—*Pathologica*. 1916. Oct. 1. Vol. 8. No. 189. pp. 311-315.

The author points out the existence of a disease affecting goats in Central and Southern Italy which corresponds with the disease known as *Boufrida* in Algeria and with the various outbreaks of pleuropneumonia in goats observed and studied in Germany by PUSCH, STORCH and HOLZENDORF in 1894-95 and in the Lower Pyrenees by LECLAINCHE in 1897. Attempts at prophylaxis and cure by means of a serous exudate obtained from the pleura of affected animals are also described.

*Etiology.* Various organisms were found at times in the lesions of animals dead of the disease but these were held to be secondary or due to post-mortem invasion. The author describes the presence of corpuscular elements in the specific lesions of the lungs, in the contents of the bronchi, and also in the fibrinous exudate on the pleura, where they are more easily seen. These corpuscles vary in size from about 1/10th of a leucocyte down to those that are almost invisible under high powers of the microscope. When examined in the fresh state they appear rounded or slightly oval, of a greenish colour, very refractile and surrounded by an evanescent halo. They are found especially in the cytoplasm of the polynuclear leucocytes, in the so-called transition forms, in detached epithelial and endothelial cells, and also free. They appear to be attached in varying numbers to the periphery of the cells which seems to be protuberant. They are immotile but the free-lying ones exhibit Brownian movements. Attempts at staining with the ordinary dyes proved unsuccessful, except that a few elements were partially stained by the Ziehl-Mori method. In deeply stained preparations they show up very clearly as negative refractile images surrounded by the stained tissue elements.

These corpuscles appear to be very similar to those discovered by the author in pus from cutaneous lesions of equine epizootic lymphangitis, in that they have the same aspect as the bodies found in the interior of the hyphae and conidia of the hyphomycetes which he isolated. They might also be compared with some of the intracellular elements described in some diseases due to filterable viruses.

Attempts at cultivation were made by placing aseptically small pieces of the fibrinous exudate in a liquid medium ordinarily capable of preserving the tissue elements intact. In the majority of cases it

was found on incubation that the material became disintegrated and produced turbidity in the liquid. On examining the deposit the fibrinous network was found to have disappeared and the cytoplasm of the cells broken up thus liberating the corpuscles. No other organisms were found. Increase in number seemed to take place. On staining with Ziehl-Mori they appeared distinctly acid-fast. The author believes that cultivation of the corpuscles had really taken place owing to their apparent increase in number, and the disintegration of the fibrinous exudate.

On transplantation into liquid media a slight turbidity and deposit were produced which on microscopic examination revealed corpuscles as in the first culture, and other rare variable wavy forms similar to those described in cultures of the virus of bovine pleuro-pneumonia.

*Transmission of the disease.* Former observers maintained that it was impossible to transmit the disease even by inoculation of material from lesions. The author's experiments showed that it was possible only to obtain a thermal reaction by intra-pleural inoculation after a few days, and other slight phenomena. By intra-pulmonary and intra-cardiac inoculation a more intense reaction was produced, although not comparable to what is observed in the natural disease. Intra-pulmonary and intravenous inoculation of serous exudate diluted and passed through a Berkfeld filter produced a febrile condition which lasted some days but no other noteworthy symptoms.

Whilst the rabbit, pigeon, and dog did not react to the inoculation of various pathological products some guinea-pigs inoculated subcutaneously, or into the lungs or pleural cavity, died within 15 to 20 days without showing any characteristic symptoms, or visible lesions on post-mortem examination; no organisms could be cultivated on ordinary media.

The inoculation of the acid-fast bodies after cultivation produced in goats a disease similar in most appearances to the natural disease but the complete clinical and anatomic-pathological picture was not produced. Two guinea-pigs inoculated with a 28 days culture of corpuscles died on the 19th day, both having showed identical symptoms, not comparable, however, to those of the natural disease in goats.

The author recalls the fact that in a similar disease, viz., bovine contagious pleuro-pneumonia, it is not possible to reproduce the typical symptoms of the natural disease no matter in what way the virus is inoculated. It is also probable that the virus of exudative pleuro-pneumonia of goats at some stage of its existence possesses the character of filterability, in view of the febrile reaction shown by goats inoculated with filtered pleuritic exudate.

*Nature of specific corpuscles.* In one of these papers the author expresses the view that the corpuscles presented a good deal of resemblance to certain minute bodies seen in certain hyphomycetes and blastomycetes and found in the body in diseases due to filterable virus. He claims to have isolated in a state of purity from two goats suffering from the typical disease a particular pathogenic aspergillus, greyish-green on culture, easily cultivated after isolation, even on ordinary media. This aspergillus, contrary to the known aspergilli, which only cause pseudo-tuberculous lesions, is instead capable of producing in goats extensive pulmonary hepatisation and pleuritic

lesions similar to those observed in the natural disease; when the conidiospores were inoculated intra-tracheally or into the pulmonary parenchyma death took place in about three days.

Corpuscles similar to those found in the pathological products of the natural disease were observed in pure cultures of the aspergillus isolated, both in the interior of the hyphae and free-lying. They were also found in the lungs and pleura of the inoculated goats. Very few hyphae were found in the lesions as these seemed to have become disintegrated, setting free the corpuscles. A full description of the experiments, etc., is promised in a later communication.

(291) CONREUR (Ch.). **Cachexie osseuse des équidés. Cachexie vermineuse des équidés. Cylicostomose.** [Equine Osseous Cachexia. Equine Verminous Cachexia. Cylicostomiasis.]—*Bull. Soc. Path. Exot.* 1916. Oct. Vol. 9. No. 8. pp. 600-633.

In this memoir the author describes a disease of horses, mules, and asses occurring in Brazil, where it is known under the name of "*Cara inchada*" or "big head." It is apparently the same affection as what is known variously in other countries under the name of osteoporosis, osteoclastia, osseous cachexia, osteomalacia, enzootic ostitis, or gout. The name "cylicostomiasis" is given to the disease to indicate the verminous origin which the author attributes to it.

Cases of the disease among mules and asses are comparatively rare, although a number of cases are on record. The disease particularly attacks young horses and it appears in them as a rule between the ages of two and two-and-a-half years. The incidence of the disease becomes proportionately less as the animal gets older. Young imported thoroughbred horses placed in a contaminated medium are easily attacked and frequently show symptoms from five to six months after their arrival. Young heavy and cross-bred horses are also fairly easily attacked and may become affected with "big head" less than a year after their arrival. Horses of the above type born and bred in Brazil may also show signs of the disease before they are two years old. Brood mares, even when they have reached adult age, are more predisposed to contract the disease than entires. Native animals seem to offer far more resistance to infection.

*Etiology.*—The author discusses the various theories which have been put forward to account for this disease, viz., (1) that of ZUNDEL (1870), still supported by MOUSSU and others, which attributes the disease to incomplete nutrition from a chemical point of view (absence or deficiency of calcium phosphate), and (2) the bacterial theory in which either a staphylococcus, micrococcus, or diplococcus found in the bone lesions of certain animals dead of the disease has been incriminated. In support of the chemical theory it has been put forward that change of pasture or rearing on artificial pastures frequently prevents or cures the disease. It is pointed out, however, that the young thoroughbreds imported into Brazil were always supplied with abundant nourishment of good quality. The various organisms described by CAROUGEAU, CARINI, and others were found only in some cases and only at a late stage of the disease.

The bacterial theory fails to explain the following points:—  
(1) spontaneous recoveries of infected animals when transferred from

an infected district into another district ; (2) the capacity a healthy animal, which has never shown any signs of osteoporosis and has lived in contact with healthy animals, has of contaminating young animals that perchance come into contact with it ; (3) the absence of the disease in foals and yearlings, its frequency in animals two to three-and-a-half years old, and its lesser frequency at later ages ; (4) foals born from affected mothers are perfectly healthy and develop normally ; (5) improvements in cultivation and the formation of artificial and temporary pastures, artificial manuring and drainage diminish the number and severity of the cases.

These various points, which are difficult to explain bacteriologically, are on the other hand in perfect analogy with the conditions that prevail in certain parasitic diseases such as strongylosis and haemonchosis of lambs, oesophagostomiasis and verminous bronchopneumonia of bovines, etc. In the human subject cases of osteoporosis and osteomalacia due to well-known parasitic diseases occur.

The author, in a number of cases examined post-mortem, has always been able to find innumerable small worms of the genus *Cylicostomum*, in addition to other worms such as *Taeniae*, *Anoplocephalinae*, *Oxyuridae*, *Ascarides* and *Strongyles*. The constant genus of nematodes found in affected animals was represented by *Cylicostomum tetracanthum*.

*Symptoms.*—These may be divided into four stages : (1) premonitory, (2) lameness and locomotor derangements, (3) osteoporosis and fractures, and (4) osteomalacia.

(1) In the initial or premonitory stage the young horses are noticed to waste away rapidly, feed irregularly and remain lying down longer than ordinarily. Signs of slight colic, sudden lameness, and periostitis of the cannon and pastern bones are then seen. Rest produces a temporary amelioration.

(2) In the second stage, or stage of lameness and medullary derangement, or pseudo-rheumatismal stage, the young animals, which had commenced apparently to recover, now have a recurrence of lameness ; very often they appear affected in the back and seem to have twisted the vertebral column. Vegetating periostites appear on the bones of the extremities ; some are attacked with colic and intermittent diarrhoea. Various vices such as eating earth, self abuse, etc., may appear. The superficial lymphatic glands and the thyroids are enlarged ; certain nervous symptoms appear such as locomotor ataxia, recurrent lameness, paresis, etc. Probably the roaring observed in some cases is attributable to the disease. The animal turns with difficulty in its box as if suffering from pain of the vertebral column or muscles of the back. Several of the cases show signs of “ jinked ” back. These symptoms may last from three to five months or longer.

(3) The stage of osteoporosis, fractures, and “ big head.” During this stage, which occurs some time after the occurrence of lesions in parts where there is most strain, such as at the insertions of tendons and ligaments and around the joints, is noticed the tumefaction of the maxillary bones, and this very often coincides with the change from temporary to permanent teeth. Osteomyelitis sets in around the alveoli of the molars, but this is in reality one of the last symptoms to appear. In horses which are not put to work exostoses of the bones

of the limbs are less common, while lesions and deformities of the vertebral column are more frequent, thus very often giving them the appearance of animals affected with rickets. Fatal fractures may occur at this stage from very slight causes.

(4) Stage of osteomalacia.—This is characterised by the almost complete demineralisation of the bones, which increase in size or become bent on account of the weight. The molars become loose in their alveoli and the horses may grunt on account of the thickening of the superior maxillae. In this condition the animal can only feed with difficulty, becomes weaker and weaker and finally dies.

Animals imported at the age of three or four years show a more chronic picture, often only showing signs of chronic lameness, muscular atrophy, etc., without apparent cause.

*Lesions.*—In connection with the bones the lesions are first those of periostitis and ostitis at various points, and in the stage of osteoporosis, of rarefaction of the compact bony tissue, etc.

Millions of cyclostomes are always found in the caecum and colon, partly fixed to the mucous membrane and partly free. The blood always shows eosinophilia. A serous exudate is found in the peritoneal, pleural, or pericardial sacs. The intensity of the disease appears to be proportional to the parasitic infection.

The duration of the disease is difficult to determine. As regards the minimum of time, young animals imported between 20 and 24 months old may pass four to six months before showing the first symptoms and four to six months later only the more evident symptoms appear. After 10 to 15 months at Rio de Janeiro osteoporosis appears. Animals four years old or more very often develop a chronic benign form of the second or third stage, which may remain a long time unchanged.

*Diagnosis.*—During the first and second stages diagnosis is difficult to anyone without previous knowledge of the disease. It is, however, easy in a contaminated medium. Out of 25 racing stables in Rio de Janeiro the author knows of more than 10 infected ones. Examination of the faeces for the presence of cyclostome eggs should be resorted to.

*Prognosis.*—Death is generally due to fractures. During the first and second stages recovery is possible and may still be possible during the third stage, provided medullary derangements have not become pronounced. A cure is impossible in the stage of osteomalacia.

*Treatment.*—This consists in raising the tone and condition of the body and expelling the intestinal parasites. Balls made up according to the following formula are administered three or four times at intervals of from two to four days to two-year-olds :—

Thymol .....	6 grammes.
Santonin .....	50 centigrammes.
Cape Aloes .....	6 grammes.
Medicinal Soap to make	1 ball.

For three or four-year-olds the doses are increased by about a half, and if they are already infected the doses are doubled. Excellent results are claimed to follow this treatment administered during the first and second stages of the disease.

*Preventive treatment.*—This consists in the effective disposal of infected faeces, and the following are the two principal points which

should thus be followed.—(1) Avoid the introduction into stables or pastures free from parasites of animals infected with cylicostomes. (2) Where parasites exist try and destroy them by the use of certain vermicides, and cause them to disappear from pastures by the use of lime, sulphates, drainage, and, preferably, by ploughing and cultivation of suspected land.

[In the discussion on this memoir Van SACEGHEM stated that all the equines in Zambézi, Belgian Congo, are affected with *Cylicostomum tetracanthum* but that no case of osteoporosis has been observed there. When these equines are taken to Kitobola (Lower Congo) they there contract osteoporosis.]

(292) URBAIN (G.). **Encéphalo-myélite pseudo-épizootique du cheval.** [Equine Pseudo-Epizootic Encephalo-Myelitis.]—*Bull. Soc. Path. Exot.* 1916. Oct. Vol. 9. No. 8. pp. 557-561.

The author describes a very fatal disease of equines in Paraná (Brazil), where it is known under the name of “*Peste de Cegar*” (Blindness disease). The disease, which in the great majority of cases takes on a rapid course, is characterised by the following symptoms: (1) blindness, (2) circular movements followed by unilateral paralysis, (3) immobility, where the animal remains for hours without moving, and then (4) a stage of excitability, depression, coma, and death. The stage of excitability supervenes in about seven or eight hours after the appearance of blindness, and the animal suddenly shows symptoms of mania.

The disease differs from the so-called Borna disease, which also affects cattle and is characterised clinically by symptoms of cerebral excitability accompanied by muscular contractions and followed by paralysis. SIEDAMOGROTZKY and other authors state that the causal organism is a micrococcus affecting the nerve centres. In “*Peste de Cegar*” there is no forcible contraction of the muscles of the poll as in Borna disease; it also appears to be specific to the horse and outbreaks commence to occur during the Brazilian winter and disappear completely in summer, whereas the Borna disease reaches its maximum intensity in summer.

On post-mortem examination the following lesions are found. The stomach is greatly dilated and filled with undigested maize in a state of fermentation. Its mucous membrane is considerably inflamed. The other organs and viscera shows signs of intoxication. The most important lesions are found in the nervous system and consist in congestion of the frontal convolutions and hæmorrhages into the optic lobes, the corpora striata, or into the medulla. The lateral ventricles are filled up and the nerve cells in contact with the cerebral fluid are degenerated, presenting thus at first sight the appearance of an abscess. The spinal cord shows the same lesions.

The stomach contents are found to contain an *Aspergillus*, on microscopic examination. No organism was found in the blood or in the nervous system. The inoculation of blood and cerebral fluid into the rabbit, rat, horse, and sheep gave negative results.

The author believes that the disease is due to an *Aspergillus* found in maize for the following reasons:—

(a) On post-mortem examination a large number of moulds of the aspergillus type are always found in the maize and in the stomach of

animals dead of the disease; (b) the disease appears especially in the spring when conditions of warmth and moisture are favourable for the development of moulds in newly harvested maize; (c) the disease is only found in animals that have eaten maize; (d) if the maize is scorched before use no horses are lost from this disease.

DUPONT'S theory that the disease is caused by a virus found in marsh water is inadmissible because the disease only attacks horses belonging to carters, and these horses are never allowed to graze in the fields and are fed almost entirely on maize bought in wayside shops; further, when a case of the disease occurs their horses are turned into the prairies and no further cases occur.

(293) URBAIN (G.). **Méningo-encéphalo-myélite des poules (? spirillose).** [Avian Meningo-Encephalo-Myelitis (? Spirillosis).]—*Bull. Soc. Path. Exot.* 1916. Oct. Vol. 9. No. 8. pp. 561–563.

This is a disease known locally under the name of “*Ar*,” affecting adult fowls in the State of Paraná, Brazil. It is not contagious and only affects a few fowls in each poultry run. The disease lasts from 15–30 days and the symptoms shown are first, somnolence and inappetence, then conjunctivitis, followed by keratitis affecting first one and later both eyes, and then symptoms of meningitis as shown by forced contraction of the neck muscles causing the head to touch the body. The wings and feet later become paralysed and a day or two before death the animal shows epileptiform fits.

On post-mortem examination the liver, spleen, kidneys, and heart are found to be affected with degeneration; the meninges are inflamed and a lemon-coloured fluid is found between them and the brain. Petechiae are found in various parts of the brain and spinal cord. The blood shows a marked eosinophilia.

In the conjunctival secretions, the aqueous humour of the eye, pharyngeal secretions, intestinal contents, and nervous substance a micro-organism was found in the form of a Spirillum which stains blue with Giemsa and shows two or three red stained granules. This organism was found in pure culture in the eye and brain. Negative results have so far followed attempts at transmitting the disease by inoculation of products from diseased birds into rabbits and fowls.

(294) VAN SACEGHEM (R.). **Travaux du Laboratoire de Bactériologie vétérinaire de Zambi (Bas-Congo).** [Investigations carried out at the Laboratory of Veterinary Bacteriology at Zambi, Lower Congo.]—*Bull. Agric. Congo Belge.* 1916. Mar.-June. Vol 7. No. 1–2. pp. 114–130. With 10 text-figs.

(I) EPIZOOTIC ABORTION OF ASSES AT ZAMBI, pp. 114–116.

In a previous report (1914) the author gave the opinion that epizootic abortion was a clinical identity, with specific causal organisms in each case, for bovines, equines, and ovines, respectively.

The bacillus, the cause of epizootic abortion in asses at Zambi, was found in enormous quantities in the stomach and blood of the foetus, as well as in the spleen, liver, lungs, and the foetal membranes; the uterus and vagina of affected animals also harbour the germs.

The bacillus is very small; it is motile, but does not execute any appreciable translatory movements. On agar a growth is seen after 24 hours at 37° C.; a growth is even obtained at ordinary temperature (average 26° C.). In broth young cultures give a uniform turbidity; in old cultures flocculi are seen.

Cultures are only feebly virulent for small laboratory animals.

Clinically, the disease is manifested by abortion and between two successive abortions the animal shows no symptom. The vaginal discharge, seen after abortion, is sometimes very transient in character.

The author employed the agglutination test in order to diagnose the disease, using as emulsion a 24 hour-old broth culture of an organism isolated from a foetus. It seems that the maximum agglutination produced by the serum of chronically affected asses is given in dilutions of 1/200. The serum of an ass that had never aborted and of equines and bovines gave entirely negative results.

The disease observed at Zambézi seems to be specific for the ass, of any breed or origin. Attempts at infecting horses and bovines failed completely.

The author has tentatively employed vaccination by means of cultures of the specific organism killed by heating. Injection was followed by a marked local reaction of varying intensity together with an appreciable febrile reaction. The results of this treatment are not given.

The author has been able to adopt all the necessary prophylactic measures by employing the agglutination test for diagnosing the presence of the infection among infected animals.

(II) PIG-BREEDING IN THE ZAMBÉZI DISTRICT LOWER CONGO, pp. 116-123. With 6 figs.

The black native pig of this district is not suitable for profitable breeding owing to its degenerate nature; the average weight is about 30 kilogrammes. A priori it is, however, more advantageous to ameliorate a native breed, adapted to the environment and possessing a specific resistance against the prevailing diseases. Experiments made at Zambézi have nevertheless proved that the produce obtained by crossing a pure Belgian breed with the native pig have given surprising results, in that while they inherited the resistant qualities of the native pig they showed marked increase in size and weight; three months old young pigs of 3/4 Belgian breed exceeded in weight the pure Belgian pigs.

The diseases affecting pigs in the lower Congo are numerous but fortunately have nearly all been identified and suitable methods of treatment adopted. The following is a list:—

(1) Disease of young pigs due to a bacillus of the typhoid group.

(2) *Myiases*. These are particularly prevalent in the rainy season and are produced by the larvae of a fly (*Lucilia sericata*, Meig.). Treatment consists in the application of 10% carbolic ointment to the wounds.

(3) *Parasites*. The most formidable is a chigger (*Sarcopsylla penetrans*). This makes its appearance in the dry season when the female fixes itself on to the skin; the infection is spread indirectly by means of infected piggeries, etc. The chigger may cause serious damage both on account of the sores it produces and by obstructing the teats, which



are sometimes so thickly covered that the mothers refuse to suckle their young. Treatment consists in placing the pigs at some distance from native dwellings and disinfection of piggeries, especially during the dry season. Two other kinds of parasites are also frequently found on pigs, viz., Haematopinus, and ticks (*Rhipicephalus appendiculatus*, *R. simus*, *R. bursa*). The only practical means of getting rid of these vermin is by systematic application of the dipping tank method.

(4) *Cysticercus cellulose*, the cause of measly pork, is common, and pigs should thus be kept away from places contaminated with the excreta of natives.

All pigs were found to be affected with *Balantidium coli*. Streptococci, spirochaetes, and infusoria which resembled the genus *Butschlia*, were found in the intestines of young pigs.

(5) The bulb of a certain plant (*Albucca variegata*, Wild) was reported to have caused considerable mortality among pigs in the Moanda district; experiments made by the author showed that injection of this plant into pigs did not produce any harmful effect.

The only species of trypanosome found in the Zambesi district resembles the *T. cazalbovi*, but differs in certain details. This trypanosome is devoid of pathogenicity for the pig.

(III) A NEW BACILLUS (*B. zambiensis*), pp. 124-125.

This is a saprophyte always found on the skin of bovines, equines, and antelopes in the lower Congo. It is polymorphous, often seen in the form of short filaments,  $5 \times .7\mu$ . In these filaments are seen refractile bodies, about six in number, which are the sporulating forms of *B. zambiensis*. The bacillus is also seen in the form of separate rods of variable length up to  $3.6\mu$  by  $.7\mu$  broad. Besides these two forms one may observe a strepto-bacillary form in which the more or less long chains are curved or interlaced.

The bacillus grows very well at ordinary temperatures on agar and Sabouraud agar, in the form of a strepto-bacillus and isolated forms. These become transformed into spores for the most part on the eleventh day. Agar cultures are thick, creamy, viscous, and dirty white in colour. Towards the seventh day the film becomes wrinkled, giving rise to elevations with serpiginous margins. The bacillus is strictly aerobic. In ox serum the bacillus grows with the same characters, giving rise to a surface film from which grows a flocculent deposit.

Transplantation on to Sabouraud medium is difficult, growth is slow and the bacilli are only found in the form of simple isolated forms. The bacillus is surrounded by a capsule.

The organism shows no pathogenicity so long as it remains on the skin. As soon as it gains access to the cellular tissues it becomes virulent.

(IV) A CUTANEOUS MYIASIS. pp. 125-127. With 1 fig.

The cutaneous myiasis observed in the domesticated animals are produced by the larvae of Muscidae belonging to the sub-families Muscinae and Sarcophaginae.

The author has observed several cases of this disease in breeding stock at Zambesi. All were complications of accidental wounds. One of these lesions was found on the external surface of a pig's ear, another on the posterior part of a cow's udder, and a third on the testicle of a young bull. All these sores present the same aspect; they are

3 to 4 cm. deep by about 3 cm. broad, give rise to an offensive odour and show abundant bleeding and budding. A mass of moving larvae is found inside the sores and behind the fleshy buds. The margins of the sores are perpendicular and the surrounding tissues are considerably indurated. The affected animals are considerably depressed, and show lack of appetite and wasting.

The larvae are described as being all identical, of a dirty-white colour, very active, 15 to 17 mm. long by 5 mm. broad; the head is furnished with two black sharp hooklets showing synchronous movements. A piece of meat 3 cm. long by about 2 cm. broad was completely devoured in 24 hours by 10 larvae. The cephalic end of the larvae is pointed, the posterior end of the body is broadened out. The body is divided into 12 movable segments, each segment being covered with several rows of small spines of a brighter colour and directed backwards. The author succeeded in rearing the larvae, which became transformed into pupae and then gave rise to insects of the genus *Lucilia*.

Treatment consists in the application of 10% carbolic vaseline to the sore, which becomes closed up after a few days.

(V) A CASE OF STYFZIEKTE AT PASO-KONDE, NEAR ZAMBI. pp. 127-130. With 3 figs.

This disease is well known in South Africa, where it has been described by THEILER. It has not hitherto been identified in any other parts. The animal described was reported to be lame and on examination by the author was found to be in good general condition but presented peculiar movements, viz., it walked on the heels of all four feet, taking short steps, the hoofs were hot and considerable pain was felt on pressing the shoulder. Examination of gland juice as well as of the blood proved negative. No improvement was observed in the course of many weeks. Observed afterwards at the laboratory the acute symptoms disappeared after some weeks but the deformation of the hoof became daily more and more marked. All the hoofs became longer than those of other animals. No articular lesion was noted.

In South Africa the disease has been attributed to poisoning by *Crotalaria burkeana*, but THEILER believes that other agents are capable of producing the affection as well. The affection appears to be common on pastures where there is an acid vegetation.

This case observed at Zambesi differs in some respects from the majority of cases of Styfziekte, in that there was simply a lengthening of the hoofs and it apparently resembled laminitis of equines. There was no lack of phosphates in the earth of the district and no *C. burkeana* was found, but there were many very damp marshes with an acid vegetation.

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#### TECHNIQUE.

(295) NORRIS (R. V.). A Comparison of the "Defibrination" and "Oxalate" Methods of Serum Preparation as applied to Haemorrhagic Septicaemia and Anthrax Sera together with Some Analyses of Buffalo and Hill Bull Blood.—*Bull. Agric. Res. Inst. Pusa*. No. 60. 15 pp. 1916. Calcutta: Supt. Govt. Printing.

In these notes a brief account is given of some comparative experiments carried out at the Muktesar Laboratory, India, in which the

above two different methods were examined in order to determine the influence on the yield and quantity of the serum in each case.

After immunisation each animal at present is bled three times in series at intervals of four days, the quantity of blood withdrawn each time being at the rate of 6 cc. per lb. body weight.

*Defibrination method.* The blood is drawn into bottles containing a coil of copper wire, is defibrinated by shaking, and the defibrinated blood then centrifuged.

*Oxalate method.* The blood is run into bottles containing 10 cc. of a 10 per cent. solution of potassium oxalate per litre of blood. In the case of buffaloes the corpuscles settle very quickly and a large proportion—50 per cent. of the blood—of clear plasma can be syphoned off. The residue is then centrifuged. In the case of hill bulls the whole of the blood has to be centrifuged as the corpuscles show no tendency to settle. The oxalated plasma is clotted by the addition of 10 cc. of a 12 per cent. solution of calcium chloride to each litre of plasma. The contraction of the clot is accelerated by the addition of weights.

The results of these experiments are given in the tables of which the following two represent a summary :—

TABLE XII.

Haemorrhagic Septicaemia.				Serum Yields.	
Animal.	Nature of Bleeding.			Average yield of serum. Percentage of whole blood drawn.	
				Defibrination method.	Oxalate method.
	Bledings.				
Buffaloes ..	1st .. ..			50·6	56·4
"   ..	2nd .. ..			52·0	59·2
"   ..	3rd .. ..			58·5	62·8
Hill Bulls ..	1st .. ..			48·3	57·1
"   ..	2nd .. ..			52·7	56·2
"   ..	3rd .. ..			—	56·4

TABLE XIX.

Anthrax.				Serum Yields.	
Animal.	Nature of Bleeding.			Average yield of serum. Percentage of whole blood drawn.	
				Defibrination method.	Oxalate method.
Buffaloes ..	1st .. ..			48·6	56·6
"   ..	2nd .. ..			54·3	59·4
"   ..	3rd .. ..			61·7	63·7

A chemical analyses of a number of buffalo and hill bull bloods and of their various constituents was also made. The results are given in the following summary :—

“(1) In the preparation of haemorrhagic septicaemia and anthrax sera the oxalate method gives a considerably increased yield of serum as compared with the defibrination method.

“(2) The serum prepared by the oxalate method is greatly superior in appearance to that obtained by defibrination and centrifugalisation.

“(3) In the case of buffalo blood the oxalate method saves 50 per cent. of the centrifugalising as the corpuscles settle rapidly and the plasma can be syphoned off. This point is of considerable practical importance where large quantities of sera are dealt with as the consequent economy in engine power entails an appreciable saving of expense.

“(4) With hill bull blood the corpuscles show little tendency to settle and the whole of the blood has to be centrifugalised as in the defibrination method.

“(5) In both haemorrhagic septicaemia and anthrax bleedings if a series of bleedings be taken at short intervals the yield of serum increases progressively, the third bleeding giving a larger percentage of serum than the second which in turn yields more than the first.

“(6) Analyses of normal buffalo and hill bull blood show that the serum from the latter animal contains a considerably larger percentage of globulins than does that from buffaloes. This seems to be the chief point of difference between the two bloods.”

(296) LANGE (C.). *Die Bedeutung der Salze für spezifische Agglutination.* [The Importance of Salts in Specific Agglutination.]—*Zeitschr. f. Immunitätsforsch.* 1916. June 8. Vol. 24. No. 6. pp. 587–620.

Summary :—

“According to the new tests employed in our researches one must, in the study of the question as to what importance salts have in specific agglutination, place in the foreground the fact that the agglutinin is not a single body, but is composed of various protein fractions of the serum that act differently also in the course of agglutination on account of their chemical and physical differences.

In order to find out how agglutination, or even only a part of it, viz., the combination of the agglutinin with the agglutinable substance, takes place in a salt-free medium one must take into consideration the fact that a part of the agglutinin (I), which is composed of euglobulins and pseudoglobulins insoluble in water, remains undissolved in the salt-free medium and consequently does not enter into the question of agglutination, a fact which earlier workers have not borne in mind.

“As regards this portion of the agglutinin the salt only plays the rôle of holding the protein substance in solution and this can be done equally well by means of a trace of soda.

The importance of the salt in the phenomenon of agglutination is not, however, here exhausted ; by quantitative analysis of the occurrences it is seen that a portion of the agglutinin, belonging to the albumins, can bring about agglutination in a perfectly salt-free medium. This portion of the agglutinin (II) appears to be inconstant or at all events to be present only in very small quantities.

“In addition to this the salt appears to play a part analogous to Bordet’s tonic suspensions in that the sensitized bacteria are kept more easily dispersed in the presence of a neutral salt.

“A division of the course of agglutination into two phases, viz. (1) combination of the agglutinin with the agglutinable substances, which can take place in a salt-free medium, and (2) clumping through the agency of the salt, can no longer be considered correct in the light of our experiments.

“The theory of the binding of the (whole) agglutinin to the agglutinable substance in a salt-free medium can no more be looked upon as valid according to our experiments.

“The salts thus play a different rôle for the different portions of the agglutinin; for agglutinin I. they are necessary especially to hold this portion in solution, for agglutinin II. they are altogether unimportant, and in the third instance they apparently have only the importance of an accessory physical agent which favours the clumping without being absolutely necessary for the accomplishment of the phenomenon.”

(297) LESCHLY (W.). **Versuche über Komplement. I. Komplement und Ambozeptor.** [Experiments on the Complement.]—*Zeitschr. f. Immunitätsforsch.* 1916. Apr. 18. Vol. 24. No. 5. pp. 499-540.

Summary:—

“When fresh sheep blood corpuscles and fresh guinea-pig serum are employed the titer and action of the complement is within very wide limits little dependent upon the quantity of amboceptor employed, provided that the latter is sufficient to produce total haemolysis. On the contrary, the titer and action of the amboceptor is very little dependent on the quantity of complement, provided that sufficient quantity is employed to bring about total haemolysis.

“If larger quantities (more than 20 units) of amboceptor are employed, the conditions are rather different; all stronger amboceptors had even in a quantity up to 200 units only a slight influence on the action of the complement, whilst the weaker amboceptors in larger doses had an inhibitory effect on haemolysis. Out of the amboceptors tested six had a very different action in that they produced haemolysis by themselves in larger quantities, apparently because the complement in them had not been sufficiently destroyed.

“On storing, the resistance of the blood corpuscles becomes decreased, more quickly when held in a 5 per cent. suspension than when freed as far as possible from salt solution. The diminished resistance shows itself first of all by an increase in the titer of the amboceptor. Only after this has taken place is the action of the complement dependent on the quantity of amboceptor.

“The resistance of the blood corpuscles is considerably diminished by lying in contact with the amboceptor.

“On the other hand, the resistance is apparently not dependent on whether the corpuscles have been washed once or several times, or on whether they have been procured by defibrination or by the addition of citrate or oxalate solutions to the blood.

“The action of stored complement is likewise dependent on the quantity of amboceptor to a far higher degree than is the action of a fresh complement. This change in the complement is manifested whether the guinea-pig serum is stored with the mixture or separate from it, and more quickly at higher than at lower temperatures. Neither in the case of amboceptors nor in guinea-pig sera were there brought out individual peculiarities of a practical importance in the sense that Scheller indicated. On the other hand there were found differences in the degree of rapidity with which the amboceptors haemolysed and combined.

“Ox blood corpuscles showed the same characters as sheep corpuscles but the fresh corpuscles (i.e., those just procured from the slaughterhouse) sometimes showed diminished resistance.

“Also, in a haemolytic system with pig blood corpuscles, an increase in the quantity of amboceptor employed did not make it possible to diminish the quantity of complement necessary for total haemolysis.

“Contrary to the assertion of Scheller, the action of the complement, measured by the final result, is in reality decided by the absolute quantity and not by the concentration employed.

“On the other hand there exists a distinct relation between the rapidity of haemolysis and the concentration of the complement, inasmuch as the quantities of complement that haemolyse in different volumes with

the same rapidity are proportional to the volumes used in each case, i.e., the same complement concentration produced haemolysis with the same rapidity.

"As against the statements of Scheller, titer doses of complement are capable of completely haemolysing only a slightly larger quantity of blood than that for which the titer is determined. By increasing the quantity of blood, a certain quantity of complement ordinarily haemolyses absolutely larger, but relatively smaller, quantities."

## REPORTS AND MEMORANDA.

(298) **EGYPT. Ministry of Agriculture. Veterinary Service. Annual Report for the Year 1915.** [LITTLEWOOD (W.), Director, Veterinary Service.]—pp. vi + 59. 1916. Cairo: Govt. Press. [Price P.T.5.]

This report comprises three sections dealing, respectively, with (1) Contagious Diseases, (2) The Veterinary Pathological Laboratory (MASON, F. E.), and (3) School of Veterinary Medicine (RABAGLIATI D. S.).

### SECTION 1. CONTAGIOUS DISEASES.

In this section statistics are given with regard to the number of cases of the various diseases reported and their distribution in the various provinces, together with the figures for the preceding year. The figures for the year 1915 are as follows:—

Cattle plague 358 deaths, together with 110 additional cases in the Alexandria quarantine pens and abattoir amongst cattle imported from the Sudan. The number of cattle doubly inoculated, that is, with virulent blood and serum was 4,833, among which 29 deaths occurred; 104,916 were inoculated in 1914. 781 cattle that had been immunised in June and July 1912 were tested with virulent blood and none died after the operation, showing that a high degree of immunity had been conferred. The number of deaths from cattle plague was the smallest since the disease was introduced in 1903.

Rabies, 65 cases—57 dogs, 1 cat, 5 monkeys, and 2 horses. Glanders, 52 cases, as against 37 cases in 1914. Epizootic lymphangitis, 13 cases. Anthrax, 11 deaths. Sheep pox, 99 cases. Foot-and-mouth disease, nil. Haemorrhagic septicaemia, 29 cases in buffaloes and cattle; in addition 18 cases were reported for the first time in Egyptian sheep. Mange, 201 cases; about half the camels of the country are probably affected in addition. Strangles, 4 cases. Spirochaetosis in fowls, 5 cases. Trypanosomiasis, 62 cases. Filariasis, 1 case. Malta fever, nil. Piroplasmiasis, 98 cases (cattle 84, horses 12, dogs 2); in addition, among the Sudanese cattle 94 cases were detected in quarantine stations and abattoirs. Tuberculosis, 1,143 cases reported, nearly all in the Cairo and Alexandria abattoirs. Tetanus, 16 cases. Ovine caseous lymphangitis, 3 cases. Cerebro-spinal meningitis, nil. Cow pox, nil. Coccidiosis, 29 cases detected in sheep, cattle, and rabbits. Equine pneumonia, nil. Contagious bovine pleuro-pneumonia, 111 cases, and in addition 1,205 cases were reported by the Sudanese Government. Stiff sickness, 215 cases. Bursati, 1 case. Ringworm, 1 horse and 1 sheep. Camel pox, 38 cases. Avian diphtheria, 170 cases.

Statistics are given dealing with the Sudan trade, which for the time being is almost the only source of cattle and sheep from abroad, the Shellal quarantine station, animals imported from other countries besides the Sudan, the isolation hospital for contagious diseases of animals at Abbassia, a census of cattle, horses, mules, donkeys, camels, sheep and goats, and animals slaughtered.

#### SECTION 2. VETERINARY PATHOLOGICAL LABORATORY (MASON, F. E.).

Figures are given showing the number of specimens of various diseases examined at the laboratory; a considerable amount of work was also done for the British Army in Egypt.

Investigations were carried on throughout the year into the nature of diseases affecting Sudanese animals arriving in quarantine. The following diseases were detected:—

(1) *Bilharziosis* (*Schistosomum bovis*). 65 cases were discovered and observations made are dealt with in a separate publication.

(2) *Cattle plague*.

(3) *Coccidiosis* (*Eimeria zurni*). In Sudanese cattle the majority of cases detected were sub-acute in character, the chief lesion being a patchy inflammation of the intestine, not as a rule producing a fatal termination. In Sudanese sheep coccidiosis (*Eimeria faurei*) has been found to be responsible for a higher mortality than any other disease. On several occasions circumstances have arisen necessitating keeping infected flocks for a considerable time before slaughter; in these circumstances precautions have been taken, with good results, for the repression of the disease, based upon the knowledge of the mode of its transmission and the life-history of the parasite.

(4) *Contagious bovine pleuro-pneumonia*.

(5) *Oesophagostomiasis*. Found to be of frequent occurrence both amongst Sudanese cattle (*O. inflatum*) and sheep (*O. columbianum*). In cattle the parasite does not appear to cause much danger and is often found in the apparently healthy animals. In sheep the effect is much more marked; it produces progressive emaciation and finally death from cachexia. The parasite has not hitherto been detected in Egyptian cattle, but has been found in sheep and pigs.

(6) *Onchocerciasis*. Three varieties were observed, viz.: (a) *O. fasciata*, found subcutaneously in Sudanese as well as Egyptian camels, causing subcutaneous fibrous growths but no general disturbance; (b) *O. armillata*, found to affect about 80 per cent. of Sudanese cattle, a similar proportion of adult Egyptian cattle, and a considerably smaller percentage of buffaloes. It inhabits the aorta and it produces loss of elasticity by the formation of extensive calcareous plates, wrinkling of the vessel walls, aneurism, and finally in extreme cases death from ruptured aneurism; (c) *O. gutturosa*, first found in Sudanese cattle inhabiting the cervical ligament. Not observed to produce effects harmful to the host. Also observed in Egyptian cattle.

(7) *Piroplasmiasis*. (*Theileria parva* and *P. mutans*).

(8) *Tuberculosis*. Appears to be quite rare in Sudanese cattle.

(9) *Trypanosomiasis* (*T. pecorum*).

(10) A small *hydatid* was found to be quite common in the livers of Sudanese cattle, closely resembling structurally the *Cysticercus bovis*,

except that the outer membrane appeared to be a little thicker. The usual seats of *C. bovis* were, however, quite free.

(11) *Gangrenous oedema* was found several times in Sudanese cattle affecting the muscular masses. The lesion bore some resemblance to blackquarter. The exudate from the lesion was found to contain in almost pure culture a small bacillus with special characters. It showed a bi-polar method of staining and was easily cultivated by anaerobic methods; the disease was transmissible both by wound inoculation of exudate and of artificial culture. Natural infection frequently takes place in wounds produced by cattle horning each other.

*Observations on diseases of Egyptian live stock—*

(1) *Contagious pneumo-enteritis* or *haemorrhagic septicaemia* of sheep was first discovered causing considerable mortality among sheep belonging to the Ministry of Waqfs. The causal organism (*B. bi-polaris ovisепticus*) was isolated from the bodies of diseased sheep in pure culture and the disease was reproduced in experimental sheep by inoculation of this organism. The disease was observed in its three forms: acute, sub-acute, and chronic. The acute form was found most frequently to affect lambs and the other forms were found in adult sheep.

(2) *Camel pox*. Variola among camels in Egypt was first observed by MASON (H.) (March 1915) in an outbreak affecting Egyptian transport camels in which 30 cases soon occurred. Subsequently several outbreaks were observed in upper and lower Egypt occurring for the most part in adult animals. The lesions are quite typical of a variola and pass through the usual stages in about three weeks. They are found on the lips, the sheath, inside the thighs, on the belly, and inside the arms. Usually the disease takes a mild form with discrete lesions in these parts and there is very little constitutional disturbance. In more severe cases the lesions become confluent and there is a marked tendency to secondary mixed bacterial invasion producing oedematous swelling of the head and sometimes of the belly, and the odour becomes offensive; conjunctivitis and ulceration of the cornea are not uncommon. Experiments were made to ascertain the relation between the camel virus and *Variola vaccinia*. Glycerinated lymph made in the ordinary way from camel pox was found to be non-infective to calves and buffalo calves, and calf lymph was found to be non-infective to camels. The susceptibility of the experimental animals, each to his own variola, was subsequently established.

(3) Tests applied to cattle immunised against *cattle plague* by double inoculation. This has been briefly referred to in Section 1.

(4) *Spirochaetosis of domestic birds*. Has long been known to affect fowls in Egypt and more recently ducks; the transmitting agent is *Argas persicus*. During the year spirochaetosis has been observed in donkeys and in geese; the transmitting tick is of the same species as in the case of the fowl disease. Treatment with organic salts of arsenic has given good results.

(5) *Sarcosporidiosis*. Sarcosporidia have already been reported in the following domestic species, viz., buffalo, ox, sheep, goat, camel (new species), and pig. During the year sarcocysts were observed in the horse, corresponding to *S. bertrami*. Sarcospores were found free in the peripheral blood of cattle in two cases where anthrax had been suspected; death was attributed to sarcocystine poisoning.



Four buffaloes that had died showing symptoms of asphyxia showed on autopsy inflammatory oedema of the larynx, fauces, and base of the tongue. All the muscular tissue in this region was crammed with the large sarcocysts formerly known as *Balbiana gigantea*, which, in Egypt, is extremely common in buffaloes, rarely found in cattle, and has not been found in other animals.

On examination, *S. cameli* was found to be as common in imported Indian camels as it is in Egyptian and Sudanese camels.

(6) *Bursati*. Some observations on this disease are made the subject of a separate publication.

(7) *Onchocerciasis*. In addition to the species mentioned above *O. reticulata* was found in the aortic wall of an Arab horse which showed a well-developed fusiform aneurism. *O. gibsoni* is stated not to exist at present in either buffalo or cattle in Egypt.

(8) "*Tropical ulcer*" in equines. This attacks imported equines in the neighbourhood of Abbassia every summer. The lesion, which may be single or multiple, takes the form of a rapidly forming ulcer about 1 to 3 inches in diameter. It is frequently observed on the skin towards the inner canthus of the eye and also on the lips; other parts are also often attacked. The disease is apparently due to wound inoculation as the smallest abrasion during an outbreak is likely to become infected and develop the typical ulcer. It is first seen under or in the skin as a small hard swelling which causes some irritation; it rapidly increases in size and about the third day the ulcer is formed with a hard base. There is no systematic disturbance.

Smears from the depth of the indurated tissue showed the presence of bi-polar organisms. The disease was reproduced by subcutaneous inoculation of cultures of these organisms. The ulcers are very resistant to ordinary drug treatment and surgical excision only spreads the infection to the wound area. Vaccine treatment gave negative results. The natural attack produces no immunity. No fungi or filaria were found in the lesions.

(9) *Pneumomycosis in horses*. Three cases were observed during the year caused by a fungus resembling *Aspergillus fumigatus*.

(10) The following ticks were identified by the Government Entomologist (Dr. GOUGH). *Margaropus annulatus*.—Repeatedly found on cattle with Texas fever and Egyptian fever. *Rhipicephalus evertsi*.—Found on cattle with Texas fever, on donkeys with malaria. *Hyalomma egyptium*.—Found on cattle with Texas fever, on horses with equine malaria, and on healthy animals, also on cattle with Egyptian fever. *Rhipicephalus sanguineus* and *Haemophysalis leachi*.—Found on dogs with malaria. *Argas persicus*.—Found associated with spirochaetosis in fowls, geese, turkeys, and ducks. *Boophilus australis*.—Found on cattle with Texas fever and during an outbreak of Egyptian fever. *Rhipicephalus oculatus*.—On healthy camels.

(11) *A new form of piroplasmosis in Egyptian sheep*. In the author's report for 1914 he described the discovery of an entirely new form of piroplasmosis in Sudanese sheep, of which the essential feature was that the causal organism was a Theileria and not a Babesia. During the year it was found that a similar disease is of common occurrence in Egyptian sheep. The causal organism, seen in the red blood corpuscles, closely resembles the corresponding element in East Coast Fever, but is even more minute. Schizonts (Koch's blue bodies) are found in the

spleen, glands, and infarcts. The spleen is enlarged to three or four times its normal weight, the kidneys contain white infarcts, the stomach shows linear congestion and the intestines some degree of patchy inflammation.

*Note on spraying of cattle with special dips for the eradication of ticks*  
(COOPER H.).

The Ministry of Agriculture decided to test the efficacy of spraying with a specially prepared arsenical dip. Cattle were sprayed all over with one part of dip to 150 parts of water at intervals of from 6 to 10 days, care being taken to treat every part of the skin including the inside of the ears. It was found advisable to spray at least five times, the cattle being allowed to return to the stable during the intervals. Old cattle sheds were destroyed to prevent their harbouring the ticks.

It was found that even in cases of very bad original infection no ticks could be detected on the skins of cattle 16 days after the fourth spraying. Three or four days elapse after spraying before the larger ticks die. Nile water was found to be preferable to well water as the latter seemed to coagulate the dip and the pumps got out of order.

A census of cattle, buffaloes, sheep, goats, camels, pigs, horses, mules, donkeys, and of animals slaughtered in abattoirs, is appended.

(299) UNITED PROVINCES. **Annual Report of the Civil Veterinary Department, for the Year ending March 31st 1916.** [OLIVER (E.W.).]  
—*Vet. Record.* 1916. Nov. 4th, 11th, and 18th. Nos. 1478, 1479, and 1480. pp. 187-189, 202-204, and 210.

The greater part of this report deals with administrative work, including the composition of the subordinate establishment, veterinary instruction, veterinary hospitals and dispensaries, and breeding operations. 145 stud bulls and buffaloes are maintained in 38 districts for use on loan under the control of the Civil Veterinary Department. Two cattle farms are maintained by the Department. 63 horse and pony stallions are maintained, and also 20 donkey stallions. Attention is also paid to sheep breeding.

*Treatment of Disease. Equine.* Only a few cases of surra occurred during the year, the decrease being due, it is believed, to the unusual scarcity of certain blood-sucking flies which generally make their appearance at the period of the year known as the surra season. Cases of horse pox, piroplasmiasis, rabies and other diseases were met with but no returns were obtainable for these diseases.

*Bovine.* Considerable abatement in the ravages of rinderpest was reported during the year and very few districts were seriously affected. Whenever the disease appeared inoculation campaigns were organised, with the result that only 3,767 deaths were recorded as against 19,839 last year.

Haemorrhagic septicaemia appeared in 36 districts and 1,593 cattle were said to have succumbed, as against 1,765 last year; 254 cattle were immunised by the vaccination method and 3,841 were inoculated, both with generally satisfactory results.

There has been a satisfactory decline in the prevalence of black-quarter. Foot-and-mouth diseases affected the province less severely

than usual. The reported losses were 1,448, the mortality being chiefly confined to young stock or old weakly and decrepit animals. Anthrax was reported in 25 districts and 738 animals died. 128 head of cattle were reported as having died from other contagious diseases, including pleuro-pneumonia, etc.

*Other animals.* Widespread respiratory disease among goats and sheep was met with in several districts during the year. The Banda district alone reported a mortality of over 1,000. Rabies, fowl cholera, and various parasitic diseases were responsible for deaths among the smaller domesticated animals.

*Preventive inoculation.* 225 outbreaks of disease and 18,661 animals were treated by this method as compared with 78,194 of last year, the enormous decrease being due to the very limited prevalence of disease in the province as reported above.

*Investigation of disease.* Investigations were conducted in connection with kamri, pleuro-pneumonia in sheep and goats, gillar bursati, akrah, fowl cholera, piroplasmosis, etc.

(300) **FEDERATED MALAY STATES. Medical Report for the Year 1914.**  
[SANSOM (C. L.)] (Reprinted from *Jl. Trop. Med. & Hyg.*  
[Colonial Medical Reports]. 1916. Oct. 2. Vol. 19. No. 19. p. 76).

**VETERINARY.**—"An outbreak of rinderpest occurred in May, at 26th mile, Kuala Selangor-Klang Road. There were 54 cases with 30 deaths.

"*Selangor.*—With the exception of January, September, and October, foot-and-mouth disease prevailed all over the State during the year. There was a total of 3,906 cases with 86 deaths. The disease was as usual of the ordinary mild type.

"*Perak.*—Three hundred and thirty-one cases were reported from this State; five died and 209 were destroyed.

"*Negri Sembilan.*—One thousand nine hundred and sixty-nine cases of a mild type occurred amongst cattle in Negri Sembilan with 28 deaths.

"There were two separate outbreaks in Ulu Pahang. 1,188 cases were detected with 20 deaths.

"There were five cases of surra in Perak, one in Selangor, twenty in Negri Sembilan, and fourteen in Pahang.

"Three hundred and forty-five cases of swine fever with 226 deaths were recorded in Selangor. A severe outbreak was found at Batang Malaka and Gemencheh (N.S.) during August. These places are situated near the Malacca boundary, and the disease was introduced from Malacca. Four hundred and fifty cases with 300 deaths were reported to have occurred before the outbreak was discovered, and a number of people had to be prosecuted for not reporting the disease. Fifty-seven cases with 38 deaths occurred subsequently, and at the end of the year the disease had been stamped out. Swine fever also broke out in the Seremban district during September, but was confined to certain areas, 271 cases occurring with 193 deaths, the majority of deaths being amongst young pigs.

"An outbreak of *pleuro-pneumonia* amongst goats occurred in a herd brought from Kedah or Siam to Lenggong in October. Out of 34 goats, 30 died; 12 cases were also reported at Grit.

"**QUARANTINE STATIONS.**—Two thousand six hundred and ninety-seven cattle were imported into Perak North *via* Port Weld, Parit Buntar, Selama, and Upper Perak, as against 4,433 in 1913.

"Two hundred and sixty-seven head of Government cattle were treated during the year by the Veterinary Department.

"*Port Swettenham.*—Four thousand five hundred and eighty-four cattle were quarantined at this Station. There were 23 deaths.

"*Bukit Sentul.*—Two hundred and forty-three cattle were quarantined and 289 released during the year, including 51 left over from 1913; five deaths occurred and 103 cases of foot-and-mouth disease were treated.

"*Kuala Kubu*.—Seventy-seven cattle were quarantined. There were 53 cases of foot-and-mouth disease, all of which recovered.

"*Negri Sembilan*.—The quarantine stations at Tampin and Port Dickson were completed during the year.

"*Pahang*.—The station at Teluk Sisek is now ready for reception of animals arriving at Kuantan by sea.

"The ground for the Raub quarantine station has been selected, but nothing further has been done.

"In dealing with all these outbreaks the Veterinary Department has shown energy and promptitude, and thus saved greater loss of life amongst cattle. The management of cattle quarantine stations has also been very satisfactory.

"During the year there were 1,346 police-court cases, resulting in 1,254 convictions, and fines amounting to \$11,830 were imposed."

(301) MONTGOMERY (R. E.). *A Memorandum on Veterinary Research as applied to the East Africa Protectorate.* 16 pp. f'cap. 1916  
July 14. MS. Report received in Colonial Office.

The object of this report is to state a case for obtaining adequate funds for the erection and equipment with personnel and materiel of a laboratory for veterinary research in the East Africa Protectorate.

An outline of the work done under present conditions since the author's appointment as Veterinary Bacteriologist in 1909 is first given. A good many of his investigations have been published at various times in veterinary journals. The author has evidently opened up entirely new ground by investigating the diseases of the domesticated animals in East Africa. A good many diseases peculiar to the country are enumerated while differences in the characteristics of other well-known diseases have been established. A considerable amount of work in the preparation of sera, especially anti-rinderpest serum, and of vaccines has also been done. The work represents a very creditable performance considering the facilities for research, though the material furnished must obviously have been enormous.

The principal lines are then enumerated upon which it is proposed to undertake research in connection with the following diseases:—Anaplasmosis and redwater, anthrax, blackquarter, colon bacillosis, contagious abortion, East Coast fever, horse sickness, Kikuyu fowl disease, epizootic and ulcerative lymphangitis, n'garuti, poisonous plants, rinderpest, swine fever, streptothricosis, tick-borne gastro-enteritis in sheep, trypanosomiasis, worm affections, and other unidentified conditions. This represents an ambitious programme and it would certainly afford excellent material for a number of enthusiastic investigators to work on.

It is also proposed to undertake routine diagnoses of specimens submitted, performance of biological tests for various diseases, and also the preparation of diagnostic agents, vaccines and anti-sera.

The author quotes the estimated value of live stock, which exceeded £4,000,000, for the year 1914, and also the climatic, grazing, and water facilities which the country affords to the breeder. An estimated capital outlay of £18,150 spread over two years, together with a yearly recurrent outlay of £17,760, is submitted as the amount necessary for the erection and maintenance of a laboratory where the above-mentioned research work could be prosecuted.

It is mentioned that over £50,000 per annum is spent by the Government of the Union of South Africa on veterinary research so as to make

“ a bid to be regarded as a stock country.” The benefits that would accrue from a proportionate expenditure on research in East Africa are claimed to be very much greater.

The trained staff would comprise one veterinary bacteriologist, three senior research officers, and four junior research officers. These would apparently include a helminthologist, an entomologist, and a chemist.

Montgomery's proposals are unhesitatingly acquiesced in by the Governor of British East Africa, but it is regretted that “ at the present time, however, our financial position precludes any undertaking of the nature recommended.”

(302) **HOOPER SHARPE (G. C.). Rinderpest Observation in German East Africa.**—Report to Chief Veterinary Surgeon, Salisbury, Southern Rhodesia, from Neu Langenburg. Dated July 25. 1916. 1 p. f'cap. MS. Report received in Colonial Office.

“ No further news of rinderpest has been received in this country, and the position remains unchanged. It is to be hoped that with the advance of our troops towards Iringa definite news of the progress of the disease will be obtained at an early date.

“ Every precaution is being taken that cattle do not enter Northern Rhodesia from this territory.

“ There is a disease in this district which at present I am unable definitely to diagnose, but I think it is East Coast Fever in the endemic form ; it does not affect the adult local cattle, but 50 to 60% of the calves bred in the district succumb to it. I have made a few post-mortems on calves and although I have only found infarcts in one animal I consider they are dying from a form of East Coast Fever, especially as other post-mortem symptoms are present. Amongst the adult cattle it is only those moved from other districts to this district that die. The symptoms among these are very puzzling ; in one instance only have I been able to find an infarct and that doubtful, but I have always observed enlarged glands, petechial markings on heart, fluid in heart sac, and inflammation of the fourth stomach. . . .”

#### BOOK REVIEW.

(303) **HERMS (William B.). Medical and Veterinary Entomology. A Textbook for Use in Schools and Colleges as well as a Handbook for the Use of Physicians, Veterinarians and Public Health Officials.**—xii + 393 pp. 8vo. With 228 figs. 1915. New York: The Macmillan Co. [Price 17s. net.]

The aim and scope of this book are indicated by the following extract from the author's preface :—“ This book is not intended to be a comprehensive treatise, touching all the investigations in the field of Medical Entomology, but rather an attempt to systematise and to assist in securing for it a place among the applied biological sciences. However, a discussion is included of all the more important diseases and irritations of man and of the domesticated animals in which insects and arachnids are concerned, either as carriers or as causative organisms.”

In accordance with the author's aims the book is essentially a practical one ; morphological details are briefly discussed while the life-history and the disease producing activities of the various insects, together with the appropriate means of keeping them under control, are dealt with forcibly and at considerable length. Accordingly, a very considerable proportion of the book is devoted to a study of such insects as mosquitoes and the common house fly, which are of no great direct importance from a veterinary point of view,

However, as might be expected from an author who had held the post of Professor of Parasitology at a Veterinary School, a consideration of the subject from the purely veterinary aspect has been by no means neglected. Besides the introductory chapters dealing with parasites and parasitism and the broad outlines of insect anatomy and classification, the veterinary surgeon will find the chapters dealing with the blood-sucking muscids, myiasis, ticks, and mites, comprising about a third of the book, of especial interest. Nearly all the conditions determined by insects in all parts of the world, together with brief descriptions of the insects, are given.

It might be complained that the descriptions of some veterinary insect diseases are rather sketchy and also that the parasites dealt with are more especially those prevailing in America rather than in England and the Colonies.

As examples of these contentions the amount of space devoted to scab and mange is comparatively small. In the case of the sheep scab parasite it is stated that "there is considerable variation in the length of time elapsing from egg to egg, 12 or 14 days is ordinarily accepted as an average"; the author could not have had in mind the recent experiments of STOCKMAN and SHILSTON on this important subject, the latter of whom showed that the period might be as low as nine days.

In the case of bovine tick-transmitting diseases it is stated that the cause of redwater is the *Babesia (Piroplasma) bigeminum* Smith and Kilborne; it is not apparently understood that *P. divergens*, at least in European cattle, is a common causal organism. The only other tick carriers of this protozoon besides the *Margaropus annulatus* Say, or *Boophilus bovis* Reilly, are stated to be the *Boophilus australis* Fuller, and *B. decoloratus* Koch; no mention is made, for example, of the common English transmitting tick, the *Ixodes ricinus*.

The book is well provided with illustrations, for the most part clear and instructive, as in the case of the diagrams illustrating the general structure of the various insects. Some, however, such as fig. 140 (*T. gambiense* in blood smear) might as well be omitted. None of the figures of the Acarini show the suckers, parts which veterinary surgeons, at least in this country, consider of great importance for diagnosis.

The book on the whole, however, must be considered as the best production on the subject that has yet appeared in the English language from the standpoint of the veterinary practitioner or student. It has already elicited highly favourable comments from such high authorities as Colonel A. ALCOCK [see *Trop. Dis. Bull.*, 1916, Oct. 30th, Vol. 8, No. 6, pp. 400-401]. The latter's concluding sentences are here reproduced as follows:—

"Taking the work as a whole, although it does not profess to be a comprehensive treatise, and although so far as its purely entomological framework goes it has some geographical limitations which perhaps carry it short of *all* the requirements of medical men whose interests lie outside the zoological regions of the New World, yet in respect of all general principles and particularly of those that underlie prevention and control, it will be found universally useful."

J. T. E.

## RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 4, No. 3, pp. 141-144.]

## PROTOZOA.

- (304) CHATTON (E.) & BLANC (G.). Un pseudoparasite *Cryptoplasma rhipicephali* Chatton et Blanc.—*C.R. Soc. Biol.*, 1916. May 20. Vol. 79. No. 10, pp. 402-405.
- (305) DANIELS (C. W.). Eye Lesions as a Point of Importance in directing Suspicion to Possible Trypanosome Infections.—*Ophthalmoscope*, 1915. Vol. 13. pp. 595-597.
- (306) FINZI (G.) & CAMPOS (A.). Anaplasmosi. Sul significato dei "Corpi endoglobulari"—"Punti marginali"—"Anaplasmi" trovati nel sangue degli ovini della Sardegna e del Piemonte. [Anaplasmosis. The Significance of "Intracorpuseular Bodies"—"Marginal points"—"Anaplasms" found in the Blood of Sheep in Sardinia and Piedmont.]—*Nuovo Ercolani*, 1916. Oct. 31-Nov. 10. Vol. 21. No. 30-31, pp. 494-500 (to be continued).
- (307) IGARAVÍDEZ (P. G.). Demostracion del piroplasma bigeminum en Puerto Rico. Nota preliminar. [Discovery of *P. bigeminum* in Porto Rico.]—*Bol. Asoc. Med. de Puerto Rico*, 1916. Sept. Vol. 13. No. 112, p. 181.
- (308) JOB (E.) & HIRTZMANN (L.). Le cycle évolutif de l'Amibe dysentérique. [The Life-Cycle of the Dysenteric Amoeba.]—*C.R. Soc. Biol.*, 1916. May 20. Vol. 79. No. 10, pp. 421-424. With 8 text-figs.
- (309) KUEBITZ (H.). Ein Fall von Pferde-Piroplasmose in Bulgarien. [A Case of Equine Piroplasmosis in Bulgaria.]—*Arch. f. Schiffs- u. Trop.-Hyg.*, 1916. July. Vol. 20. No. 14, pp. 336-337. With 1 chart.
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- (311) METALNIKOV (S.). Sur la digestion intracellulaire chez les protozoaires (La circulation des vacuoles digestives). [Intracellular Digestion in Protozoa.]—*Ann. Inst. Past.*, 1916. Sept. Vol. 30. No. 9, pp. 427-445. With 2 coloured plates.
- (312) MITZMAIN (M. B.). I. Collected Studies on the Insect Transmission of *Trypanosoma Evansi*. II. Summary of Experiments in the Transmission of Anthrax by Biting Flies.—*Treasury Department, U.S. Public Health Service, Hyg. Lab. Bull.*, 1914. No. 94, 48 pp. With 5 plates.
- (313) SHAW-MACKENZIE (J. A.). The Action of Copper Salts on Protozoa.—*Med. Press & Circ.*, 1916. July 19. Vol. 102. No. 4028, pp. 50-52.

## PARASITOLOGY.

## i. Helminths.

- (314) GONZALEZ. Le traitement de la distomatose hépatique par l'extract éthéré de fougère mâle. [Treatment of Hepatic Distomatosis by means of Ethereal Extract of Male Fern.]—*Rec. Méd. Vét.*, 1916. Aug. 15–Sept. 15. Vol. 92. Nos. 15 & 16, pp. 515–516. (Extracted from *Revista Veterinaria de Espana*, 1916. Apr.)
- (315) HALL (C.). Nématodes parasites des Rongeurs. [Nematodes Parasitic in Rodents.]—*Rec. Méd. Vét.*, 1916. Aug. 15–Sept. 15. Vol. 92. Nos. 15 & 16, pp. 517–521. [Raillet's extract and comments on memoir.]
- (316) KLEINE (F. K.). Die Uebertragung von Filarien durch Chrysops. [The Transmission of Filaria by means of Chrysops.]—*Zeitschr. f. Hyg. u. Infektionskr.*, 1915. Oct., 26. Vol. 80. No. 3, pp. 345–349.
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- (318) MAUPAS (E.) & SEURAT (L. G.). Sur le mécanisme de l'accouplement chez les Nématodes. [Mechanism of Copulation in Nematodes.]—*C.R. Soc. Biol.*, 1916. July 1. Vol. 79. No. 13, pp. 614–618.
- (319) ROMANOVITCH. *Derañophoronema cameli* (n.g., n. sp.). [A New Helminth of the Camel.]—*C.R. Soc. Biol.*, 1916. July 29. Vol. 79. No. 15, pp. 745–746.
- (320) SEURAT (L. G.). Sur un nouveau Dispharage des Palmipèdes.—*C.R. Soc. Biol.*, 1916. July 29. Vol. 79. No. 15, pp. 785–788.
- (321) VAN CLEAVE (H. J.). A Revision of the genus *Arhythmorhynchus* With Descriptions of Two New Species from North American Birds.—*Jl. Parasit.*, 1916. June. Vol. 2. No. 4, pp. 167–174. With 2 plates comprising 13 figs.
- (322) VETERINARY RECORD, 1916. Aug. 12. p. 66.—The *Pentastoma denticulatum* of Cattle. (Extracted from *Revista de Hig. y Sanidad Vet.*)
- (323) VETERINARY RECORD, 1916. Aug. 12. pp. 66–67.—Effect of Cold on *Trichina spiralis*. (Extracted from *Jl. Agric. Res.*)
- (324) ZAVADOVSKY (M.). Le développement des oeufs d'*Ascaris megalcephala* dans un milieu putréfié. [Development of eggs of *Ascaris megalcephala* in a Putrid Medium.]—*C.R. Soc. Biol.*, 1916. July 29. Vol. 79. No. 15, pp. 798–802.

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- (326) CUGURRA (A.). La "*Pulex Serraticeps*" causa di moria nei giovani gatti. [Outbreaks of Disease in Kittens due to "*Pulex serraticeps*."]—*Moderno Zootatro.*, 1916. Nov. 11. Vol. 5. No. 46, pp. 234–236.
- (327) EDWARDS (F. W.). Ten New African Haematopota.—*Bull. Entom. Res.*, 1916. Oct. Vol. 7. Part 2. pp. 145–159. With 10 figs.



- (328) LUCET (A.). Recherches sur l'étude de l'évolution de l'"*Hypoderma bovis*" et les moyens de le détruire. [Evolution and Methods of Destruction of *Hypoderma bovis*.]—*C.R. Acad. Sci.*, 1914. Mar. 16 & 30. Vol. 158. pp. 812-814 & 968-976. (Extracted in *Rev. Gén. Méd. Vét.*, 1916. Oct. 15. Vol. 25. No. 29, pp. 485-486.)
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- (334) TURNER (R. E.) & WATERSTON (J.). A New Parasite bred from *Glossina morsitans* in Nyasaland. [*Prolaelius glossinae* sp. n. Family Bethyilidae.]—*Bull. Entom. Res.*, 1916. Oct. Vol. 7. Part 2. pp. 133-135. With 2 text-figs.

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- (335) BEAUVERIE (J.) & HOLLANDE (A. C.). Corpuscules métachromatiques des champignons des teignes; nouvelle technique de différenciation de ces parasites. [Metachromatic Corpuscles in Ringworm Fungi; New Method of Differentiation for these Organisms.]—*C.R. Soc. Biol.*, 1916. July 1. Vol. 79. No. 13, pp. 604-607.
- (336) CHALMERS (A. J.) & CHRISTOPHERSON (J. B.). A Sudanese Actinomycosis.—*Ann. Trop. Med. & Parasit.*, 1916. Sept. 30. Vol. 10. No. 2, pp. 223-232. With 4 plates comprising 29 figs., & 8 tables.
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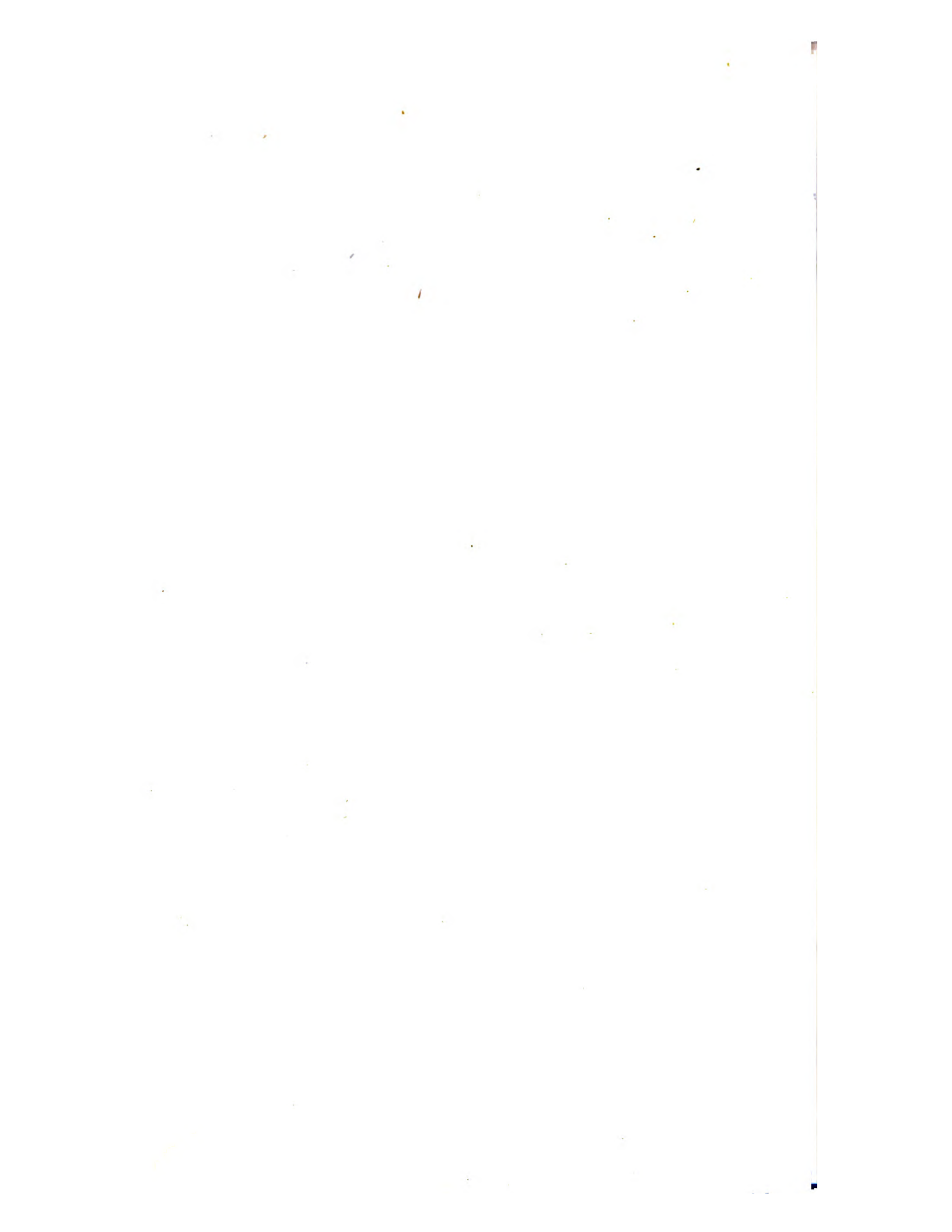
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