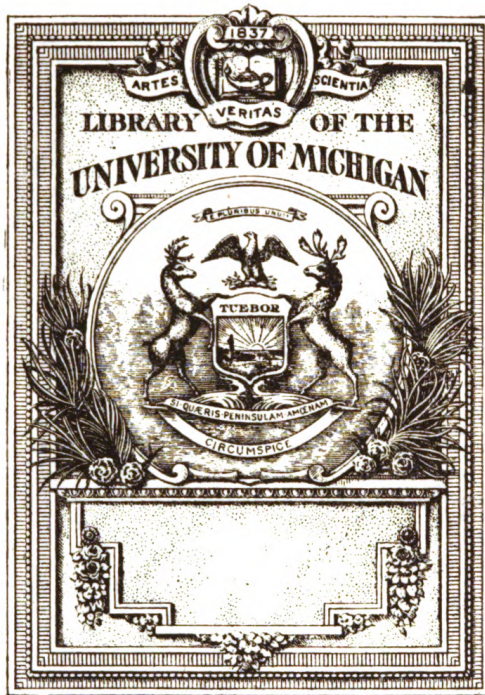
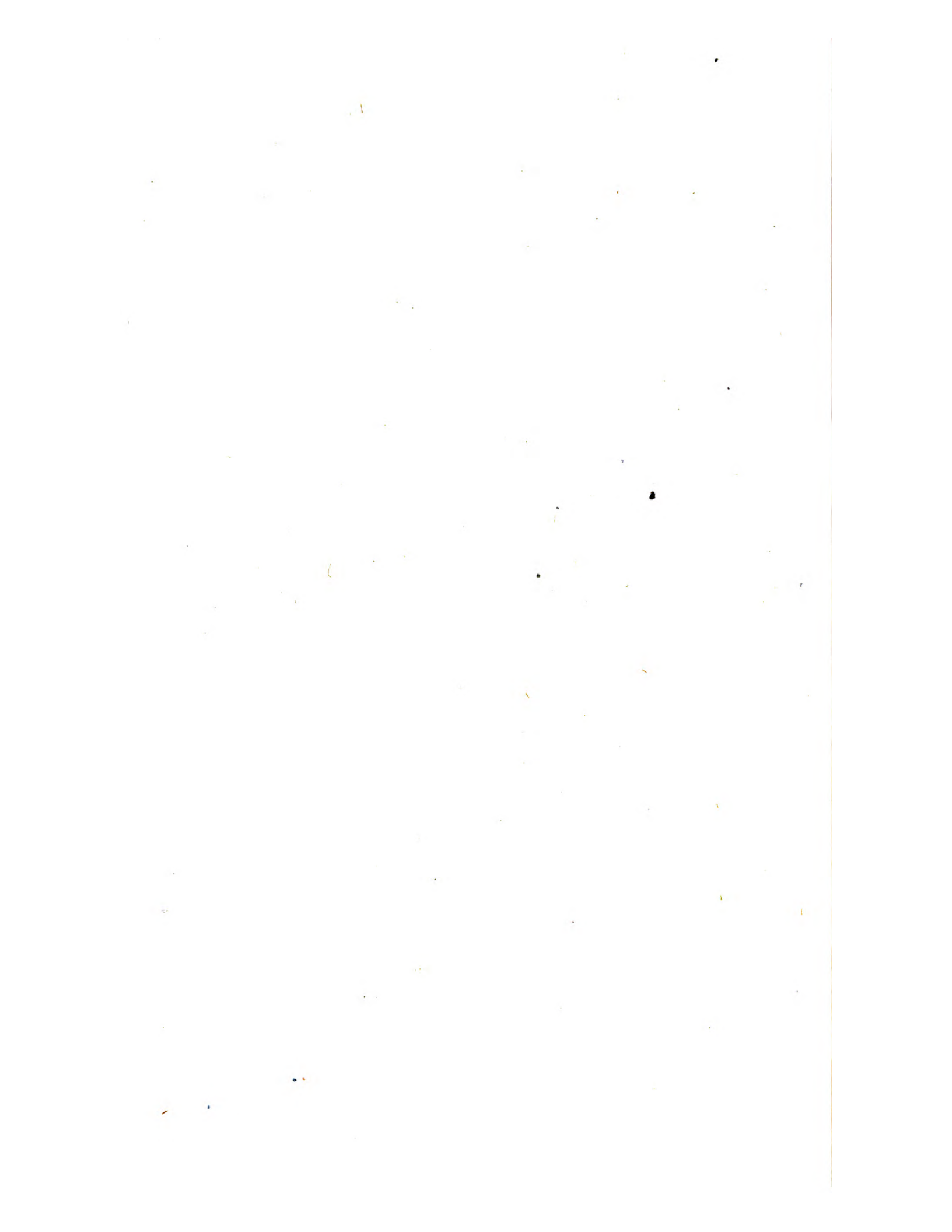



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ISSUED UNDER THE DIREC-
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MANAGING COMMITTEE OF
THE TROPICAL DISEASES
BUREAU.



General Editor:
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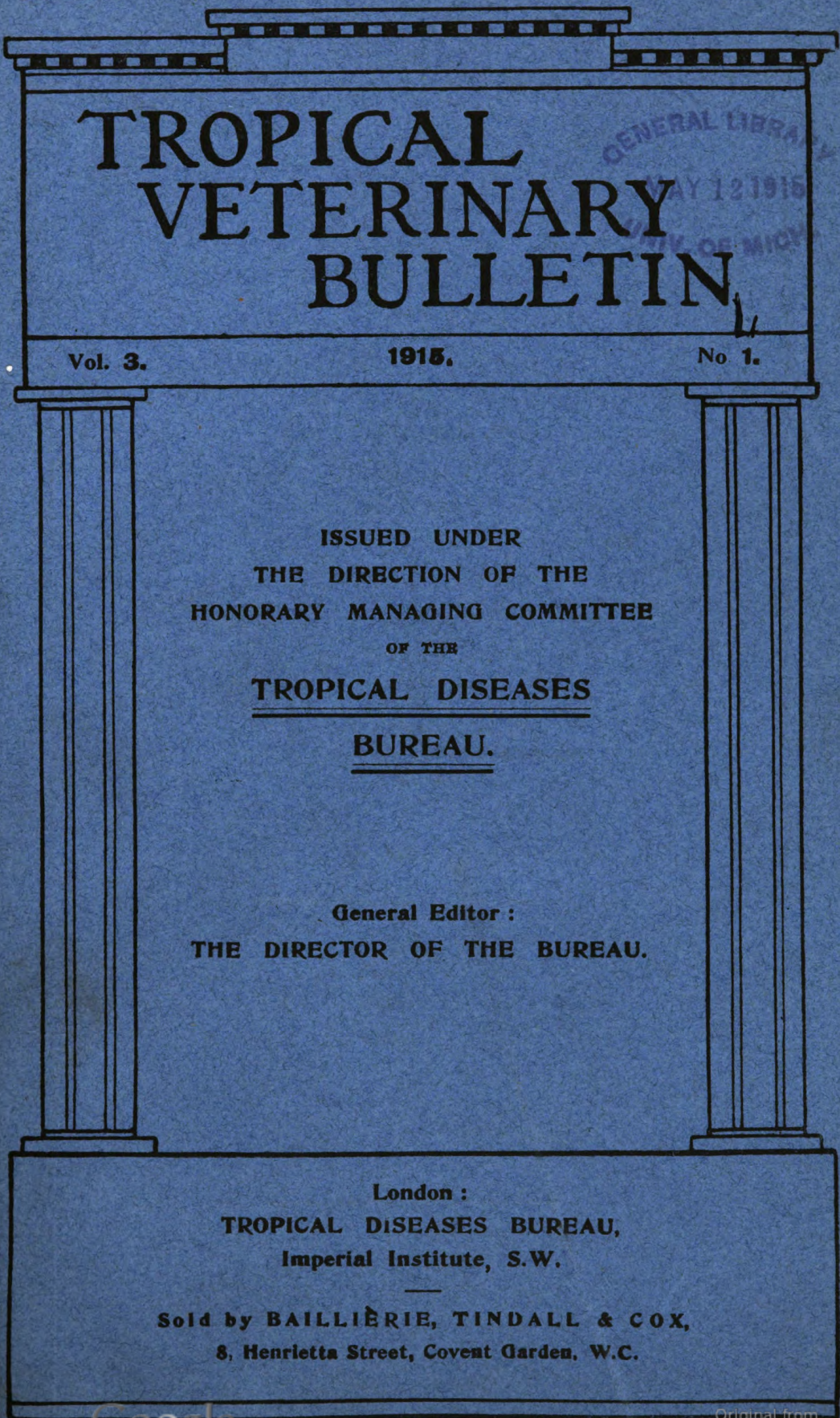


Editor of the Tropical Veterinary Bulletin :
A. LESLIE SHEATHER, B.Sc., M.R.C.V.S.

For CONTENTS, see pages 3 & 4 of Cover.

pp. 1-40.]

[March 30, 1915.



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CONTENTS.

Sections.

	PAGES.
Babesiasis (Piroplasmosis)	1-5, 41
Biting Flies	68-69, 105-111, 141-142
Book Reviews	114, 161-162
Epizootic Lymphangitis and Sporotrichosis	143-144
Helminths	28-31, 64-68, 103-105, 130-141
Leishmaniasis	19-24, 53-57, 94-96, 125-127
Miscellaneous	31-34, 70-77, 111-113, 147-153
Protozoa	25-28, 60-64, 97-103, 127-130
Rabies	69-70, 144-146
Recent Literature	39-40, 78-79, 115-116, 163-164
Reports	34-38, 113, 153-161
Spirochaetosis	24-25, 57-59, 96-97
Theileriasis	1-5, 81-83
Toxoplasmosis	59-60
Trypanosomiasis	5-19, 41-53, 83-94, 117-125

TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY
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1915.

[No. 1.

BABESIASIS (PIROPLASMOSIS) AND THEILERIASIS.

- (1) **SERGEANT (Edm.), LHÉRITIER (A.) & BOQUET (A.).** *Études sur les Piroplasmoses en Algérie. (V^e note). Infection par les Piroplasmes de Bovins arrivant de France en Algérie, pendant l'Hiver. [Algerian Piroplasmoses. (Fifth note). The Infection of Cattle arriving in Algeria from France during the Winter.]—Bull. Soc. Path. Exot. 1914 Dec. Vol. 7. No. 10. pp. 699-700.*

This short paper contains a tabular statement of the cases of piroplasmosis which have been observed in imported animals shortly after their arrival in Algeria.

The importation of cattle from Europe into Algeria is practically limited to milch cows. The table gives details of five cases, which were observed during December, 1911, and November, 1912.

The shortest period elapsing between arrival and the onset of the disease was 11 days, and the longest, 57.

The clinical features of the infection varied from case to case, and the parasites present were also variable in morphology; bacilliform, ring-shaped, and pear-shaped parasites being observed.

- (2) **SPREULL (J.).** *East Coast Fever Inoculation in the Transkeian Territories, South Africa.—Jl. Comp. Path. & Therapeutics. 1914. Dec. Vol. 27. No. 4. pp. 299-304.*

Whereas in Natal success attended the efforts made to stamp out the disease, the measures that were adopted there were inapplicable in the Transkei. The short-interval dipping system has proved to be of the greatest value by destroying the ticks. In the Transkei, however, although the value of this method was realised by the authorities, it was impossible of adoption. The difficulties in the way of providing sufficient tanks, especially in view of the short time available, and the impossibility of educating the natives to realise the value of the method, compelled the adoption of other measures. The only alternative was to practise whatever method of inoculation promised any degree of success.

The first outbreak of the disease occurred at the end of March, 1910, and the author made an attempt to carry out protective inoculation in June of that year. The results were not satisfactory, but the author admits that worse have been obtained since.

The following year THEILER'S method was adopted and by November a start had been made in inoculating animals in large numbers. Since that time considerably over a quarter of a million cattle have been treated.

The method adopted is the intravenous injection of a mixture of spleen and lymphatic gland obtained from an animal in an advanced stage of the disease. These materials are passed through a mincing machine.

Special precautions are necessary in carrying out the immunisation and these may be summarised as follows :—

- (1) The animals must be free from infection at the time of inoculation.
- (2) They should be on uninfected pasture, and should be kept there for 14 days after inoculation.
- (3) The vaccines must be prepared from materials derived from animals in an advanced stage of infection. Though such vaccines frequently cause loss they are preferable to weak vaccines, as these are apt to confer no immunity at all.
- (4) Special care must be exercised to prevent bacterial contamination, and vaccines must be used within six hours of preparation in winter and four hours in summer.
- (5) Thick vaccines are likely to cause thrombosis, and peptone is preferable to aleuronat for admixture with the vaccine.
- (6) Vaccines derived from several animals should be mixed so as to obtain uniformity.
- (7) Vaccinated animals must be placed on heavily infested land on the 15th day, and they must not be dipped.

The results depend upon the hold that the disease has on a herd. In clean herds the successes number about 70 per cent., in slightly infected herds from 50–60 per cent., and in moderately infected herds 30 per cent.

If clean cattle are inoculated when on infected veldt and kept there, the percentage of successes may be only 10 or 15. Where cattle are running on slightly infected veldt, it is recommended that they are dipped every five days for the first fortnight.

A single vaccine may give very varying results in a number of herds inoculated at the same time.

Abortion and lameness from thrombosis have been frequent accidents. Cattle should only be vaccinated at such seasons when highly infected veldt is available for a very thorough tick test afterwards.

The tick test should last for six to eight weeks according to the degree of infestation of the veldt. In winter a period of three months even does not yield such reliable results.

A second vaccination is considered advisable when a proper tick test has not been possible.

The conditions of the method indicate that it is one that cannot be practised in a civilised area except to cut short mortality rapidly in a badly infected district, and incidentally reduce the number of animals to such an extent that short-interval dipping could be adopted.

Cattle that have been inoculated and have passed through a satisfactory tick test, have maintained their immunity for three years and more.

Since the invasion of the Transkei by the disease, about 900,000 cattle have been lost, and the author believes that it will not be eradicated for some years to come, even under the most favourable circumstances.

(3) i. CHALMERS (Albert J.) & ARCHIBALD (R. G.). *Babesia* or *Piroplasma*.—*Jl. Trop. Med. & Hyg.* 1914. Nov. 2. Vol. 17. No. 21. p. 323.

ii. LEIPER (R. T.). *Babesia* or *Piroplasma*: A Reply to Chalmers and Archibald.—*Ibid.* 1915. Jan. 1. Vol. 18, No. 1. p. 7.

The following are verbatim copies of the above communications:—

“i. While searching through botanical literature in the course of a certain joint work in connection with the *Fungi imperfecti* we chanced upon the following:—

“*Schizomycetaceae* Naegeli 1857.

“Genus *Babesia* Trevisan 1889.

“*Definition*.—Cocci ellipsoidei, longitudinaliter binatim seriati (diplococci longitudinales) in filamenta moniliformia, pseudodichotoma nuda concatenati. Arthrosporae macrosomae in apice filamentorum obvenientes.

“*Etymology*.—Derived from the name of the celebrated Roumanian bacteriologist V. Babès.

“*Species*.—(1) *B. xanthopyretica* Trevisan 1889, found in people suffering from yellow fever; (2) *B. erysipeloidis* Trevisan 1889, found in people suffering from erysipelas.

“It is obvious that as Trevisan applied the name *Babesia* in 1889 to a genus containing certain bacteria, this name cannot be used a few years later to name a genus of the protozoa and, therefore, the name *Babesia* Starcovici 1893 cannot be retained.

“This brings the nomenclature of the genus of protozoal organisms discovered by Babès down to the year 1895, when Patton introduced the word ‘*Piroplasma*.’

“The synonyms will therefore stand as follows:—

“Genus *Piroplasma* Patton 1895,

“*Synonyms*.—*Haematococcus* Babès 1888 (*nec* Agardh); *Pyrosoma* Smith and Kilbourne 1893 (*nec* Péron); *Babesia* Starcovici 1893 (*nec* Trevisan); *Amoebosporidium* Bonome 1895; *Ixodioplasma* Schmidt 1904.

“This, we hope, will end the confusion in that some authors use the name ‘*Babesia*’ and others ‘*Piroplasma*’ for the same genus of protozoal organism.”

“ii. In a recent issue of the *Journal of Tropical Medicine and Hygiene* attention is called by Chalmers and Archibald to the occurrence of the term *Babesia* in botanical literature and the statement is made: ‘It is obvious that, as Trevisan applied the name *Babesia* in 1889 to a genus containing certain bacteria, this name cannot be used a few years later to name a genus of the protozoa, and, therefore, the name *Babesia* starcovici, 1893, cannot be retained.’

“It appears to have escaped the authors’ recollection that the first of the International Rules of Zoological Nomenclature stipulates that: (1) Zoological Nomenclature is independent of Botanical.”

(4) HINDLE (E.) & GÓZONY (L.). *Abderhalden’s Reaction and its Application in certain Protozoal Infections*.—*Parasitology.* 1914. Oct. Vol. 7. No. 3. pp. 228–239.

The introductory portion of this paper, which covers some four pages, outlines the nature of the reaction and explains its use, taking

as an example the diagnosis of pregnancy. Then follows a detailed account of the technique employed, special attention being directed to the controls that are essential.

In view of the fact that Gózonyi has obtained some very favourable results with the method in connection with spirochaetosis, trypanosomiasis and sarcosporidiosis, the authors have made some observations with intra-corpuseular parasites—namely, *Theileria parva* and *Babesia canis*.

Theileria parva.—Exp. 1.—A calf was infected by having placed upon it infected nymphs of *R. appendiculatus*. Parasites appeared in the blood on the 17th day. On the 20th day, when 13 per cent. of the corpuscles were invaded, a quantity of serum was obtained from the animal and tested against organs of a normal calf. As a control, a parallel set of tests were made with normal calf serum.

The following table gives the results obtained :—

Organ employed.	+ 1.5 cc. infected serum.	+ 1.5 cc. normal serum.
Brain	+	—
Kidney	—	—
Liver	+	—
Lymphatic gland	+	—
Lung	+	—
Pancreas	+	—
Spleen	+	—
Suprarenal gland	+	—
Thyroid	+	—
Thymus	+	—
Control (serum alone)	—	—
Control	—	—

The calf was killed when moribund on the 26th day. At the time of death about 40 per cent. of the corpuscles contained parasites, and at the post-mortem "all the organs were found to contain infarcts with *Theileria* present."

Pieces of the organs were prepared in the usual manner and were tested against the calf's own serum both active and inactivated.

The results were as follows :—

Organ employed.	+ 1.5 cc. infected serum.	+ inactive infected serum.
Infected Brain	+	—
„ Diaphragm	+	—
„ Heart muscle	+	—
„ Lymphatic gland	+	—
„ Lung	—	—
„ Muscle	+	—
„ Pancreas	+	—
„ Spleen	+	—
„ Suprarenal gland	+	—
„ Thyroid	+	—
„ Thymus	+	—
Control (serum alone)	—	—
„	—	—

An experiment was also made with the parasites themselves. The red corpuscles from a litre of the animal's blood were cytolysed by digitoxin, the parasites being separated by centrifugation. These

were then washed and mixed with egg albumin, which was then boiled. The resulting coagulum was tested and a strongly positive reaction was obtained. Agglutination and complement fixation tests with the parasites gave negative results.

In a second experiment carried out on the same lines three sets of tests were made. The first when the temperature rose, the second six days later—i.e., the day after parasites appeared in the circulation—and eight days later, when 30 per cent. of the corpuscles were invaded.

In each of these sets of tests active and inactivated serum was used against some of the tissues. The results were as follows:—All the tests carried out with inactivated serum were negative, as were those with active serum taken on the rise of temperature. Three out of 14—viz., tests against lymphatic gland, suprarenal gland, and isolated parasites—were positive with serum taken the day after the appearance of parasites, and nine out of 12 were positive with the third sample of serum.

In the case of *Babesia canis* less satisfactory results were obtained owing to the destruction of the red corpuscles with the resulting liberation of haemoglobin. Satisfactory results were only obtainable with blood taken during the early stages.

In the first experiment one positive result out of six tests was obtained with the serum and liver of a dog inoculated 10 days previously and destroyed three days after the appearance of parasites in the blood.

In a second experiment positive results were obtained with liver, brain, pancreas, heart, and lung, but in this case the serum used contained some haemoglobin.

TRYPANOSOMIASIS.

- (5) BRUCE (D.), HAMERTON (A. E.), WATSON (D. P.), & Lady BRUCE. *Trypanosome Diseases of Domestic Animals in Nyasaland. Trypanosoma caprae* (Kleine). Part III. Development in *Glossina morsitans*.—*Proc. Roy. Soc.* 1914. Aug. 27. Series B. Vol. 88. No. B 601. pp. 92–96. With one coloured plate.

An abstract of the previous paper regarding the morphology and pathogenicity of this trypanosome is given in this *Bulletin*, Vol. 1, page 206.

T. caprae belongs to the *T. vivax* group, which comprises trypanosomes the development of which is restricted to the proboscis of the transmitting fly.

Six experiments were carried out with laboratory-bred flies. In three instances the experiments were made at the ordinary laboratory temperature during the winter, and in the others at incubator temperature of 84° F. Of the first group two experiments were successful and the third failed, and of 34 flies used in the positive experiments only two were found to be infected. It is said that the low percentage of infected flies was no doubt explained by the

temperature, and also by the fact that sheep and goats infected with *T. caprae* are unsatisfactory for the feeding of flies, as trypanosomes are variable in their appearance in the blood and are never numerous.

In the experiments carried out at incubator temperature the percentage of infected flies found ranged from 30 to 40.

No attempt was made to study the flagellate in the fly in the early stages as sufficient flies were not available, but a number of illustrations in colour are given of the parasites as found from the 19th to the 30th day, and also of the final stage of development.

Conclusions :—

" 1. *Trypanosoma caprae* is capable of passing through a cycle of development in *G. morsitans*, the flies becoming infective some 19 days after feeding on an infected animal.

" 2. *Trypanosoma caprae* belongs to the same group as *T. vivax* and *T. uniforme*, the development taking place only in the proboscis.

" 3. The final stage of the development takes place in the hypopharynx where the trypanosomes revert to the original " blood form " and become infective."

- (6) BRUCE (D.), HAMERTON (A. E.), WATSON (D. P.), & Lady BRUCE.
The Trypanosome causing Disease in Man in Nyasaland. The Naturally Infected Dog Strain. Part I.—Morphology.—*Proc. Roy. Soc.* 1914. August 27. Series B. Vol. 88. No. B 601. pp. 111–130.
 With 3 plates and 8 charts.

The authors state that this strain differs in so marked a way from the human, fly, and game strains, that had it been found in wild game or in *G. morsitans* it would have been legitimate to make a new species of it. As, however, it was only met with in the chronically diseased dogs, the making of a new species would not be justified. The dogs were obtained in the proclaimed area, but not all infected dogs from the area showed this strain.

Attention is drawn to the fact that this strain is of very low pathogenic power for the monkey and guinea-pig, and also to the small proportion of blunt-ended posterior-nuclear forms.

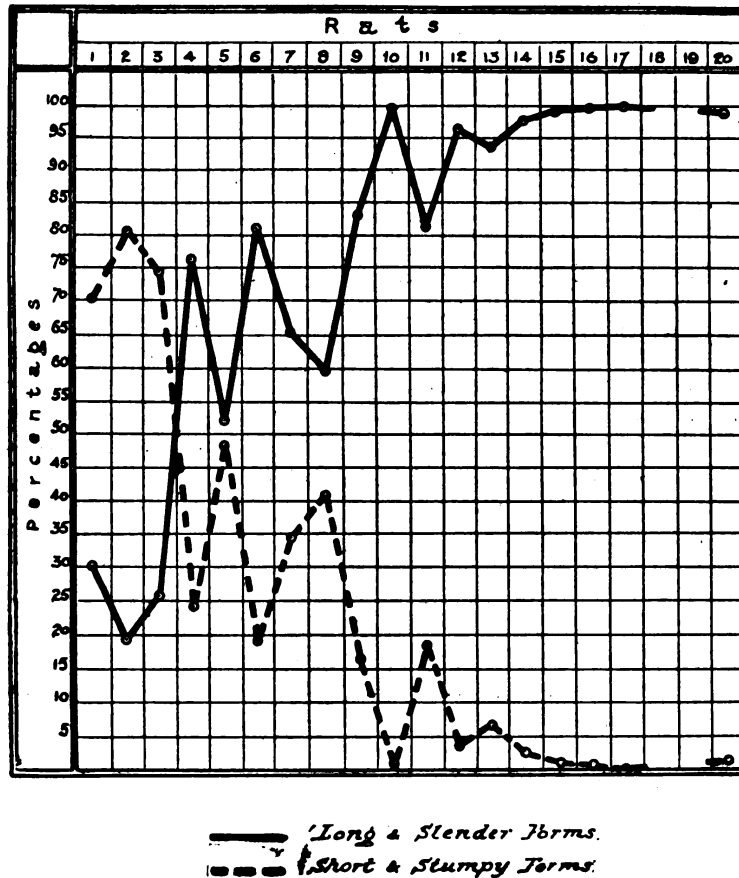
Large numbers of measurements were made of the parasite immediately after it was obtained, at an interval of seven months, and also of two years, it having been maintained in rats during these periods. In the biometric curve constructed on the first set of measurements, it was seen that while the curve indicated dimorphism there was a marked preponderance of short forms. The curve constructed on measurements after passage through eight rats (seven months) was still dimorphic, but the two peaks were almost at the same level. The curve based on the measurements taken after two years in rats was almost of the monomorphic type, the stumpy forms had almost disappeared, and the percentage of long parasites had very greatly increased.

That this was not in the nature of an accident is shown by a chart representing the gradual change of type through an unbroken series of 20 rats. In this chart, which is reproduced*, the unbroken line represents the long slender forms, and the broken line the short stumpy forms.

* From the *Proceedings of the Royal Society*.

The second of these naturally infected dog strains was found to be very markedly dimorphic, the form of the chart almost suggesting that two trypanosomes might be present.

The third strain was practically monomorphic, the majority of the parasites ranging from 26 to 32 microns in length.



“ This seems to shew how fallacious it is to reason from laboratory types of trypanosomes to the wild types, and probably accounts for the showers of new species which are constantly falling about our ears.”

In view of the possibility of there being in reality two parasites present in these infections, the third strain representing a survival of the slender parasite, an attempt was made to cause Strain 1 to revert to the original dimorphic form.

When this strain, after two years in the rat, was again inoculated into a dog, a reversion to the dimorphic form was produced. In the blood of the rat after two years' passage through rats the peak of the chart of 500 trypanosomes occurred at 29 microns, but when this strain was again passed into a dog the peak of the chart occurred at 21 microns, there being also a small rounded elevation in the curve at 25 to 28 microns. Nearly one-fifth of the parasites were now of the short stumpy type.

From these facts it would appear that passage through the rats favours the production of the long slender parasites, while passage through the dog at once causes a return to the dimorphic type.

No explanation of the origin of these strains in the dog was forthcoming, and an attempt to test the theory that long sojourn in the blood of a dog was responsible for the changes did not furnish any evidence of this being the case.

Conclusions :—

“ 1. The Naturally Infected Dog strain differs slightly from the other strains of the trypanosome causing disease in man in Nyasaland, in that there are fewer of the posterior-nucleated, blunt-ended forms which are sometimes so much in evidence in the ordinary strains.

“ 2. Taking into consideration the fact that this strain was only found in three chronically infected dogs, it is concluded that it is an aberrant strain of the widely spread species *T. brucei vel rhodesiense*, the trypanosome causing disease in man in Nyasaland.”

Part II. Susceptibility of Animals.—*Ibidem.* pp. 130–138.

The bulk of the experiments regarding the pathogenicity of these strains of trypanosomes were carried out with that called No. 1 strain, as the other two were accidentally lost.

In a tabular statement are given details of the inoculation of a large number of animals including cattle, goats, sheep, antelope, monkeys, dogs, rabbits, guinea-pigs, and rats.

The following is a summary of the results obtained :—

Four cattle were inoculated, but in one only did the infection succeed. In this animal the parasites were present in small numbers on three occasions only, and the animal recovered. Six out of 21 goats inoculated shewed trypanosomes in their blood on a few occasions and in small numbers. Four recovered and one died, but no post-mortem examination was made to ascertain whether the infection was responsible for death.

Two sheep were inoculated successfully, and one died, probably of the disease, after 64 days.

Six out of 27 monkeys were infected, but all recovered. The strain became virulent for dogs after several passages.

In four the inoculation failed to infect, and five recovered. The remainder died in from 11 to 102 days. The lesions were those of nagana.

Two rabbits were successfully inoculated, and both shewed the lesions of nagana in a rather mild form.

Two guinea-pigs out of 21 became infected, but recovered.

The strain was invariably fatal for the rat, death taking place in from 7 to 94 days (average 30·8).

The authors consider that for the present the parasite should be included among the strains of *T. brucei vel rhodesiense*, but that if it should be decided to make it a separate species the name *T. anceps* would be a suitable one. Conclusions :—

“ 1. The Naturally Infected Dog strain is fatal to dogs, rabbits, and white rats, but oxen, goats, monkeys, and guinea-pigs appear to be refractory.

“ 2. The Commission is of opinion that this is an aberrant or exceptional variety or strain of the trypanosome causing disease in man in Nyasaland—*T. brucei vel rhodesiense*.”

Part III. Development in *Glossina morsitans*.—*Ibidem*. Sept. 15.
No. B 602. pp. 213–218.

Eleven experiments were carried out and of these two gave positive results. In the first of them, flies were fed on an infected rat for five days, and then in succession on a dog, monkey, guinea-pig, duiker, and a second monkey. The period during which the flies were fed upon these animals ranged from 3 to 25 days, and they were starved for one day between successive feeds. Of this group only the guinea-pig failed to become infected.

In the second successful experiment the flies were fed upon an infected rat for six days and then after one day's starvation upon a healthy dog for 58 days. The number of days elapsing before the flies became infective were 24 and 58 days respectively. In both cases the flies were kept at 84° F, and all were laboratory bred.

Thirty flies were used in the first of the successful experiments, and when these were dissected three were found to be infected.

In one of these trypanosomes were found in the proventriculus, and in all three the fore- and mid-guts were invaded. In one the hind-gut shewed trypanosomes, and in one there were trypanosomes in the salivary glands.

It appears to be probable that the one fly having an infection of the salivary glands was responsible for all the infections.

In the negative experiments 185 flies were dissected and 11 were found to be infected. None of these, however, had any trypanosomes in either the proboscis or the salivary glands. With regard to the morphology of the trypanosomes in the flies, those present in the intestine were exactly like those of the human strain in the same situation, and the salivary glands of the single fly showing invasion of these organs contained exceedingly numerous small active trypanosomes which when stained were seen to be typical blood forms. Conclusion :

“The trypanosome of the Naturally Infected Dog strain belongs to the same group as *T. gambiense* and *T. brucei vel rhodesiense*, the trypanosome causing disease in man in Nyasaland, and is probably merely a weak strain of the latter species.”

Part IV. Experiments on Immunity.—*Ibidem*. pp. 219–226.

This paper contains in tabular form the details of a number of experiments carried out with the object of ascertaining whether the “Naturally infected dog strain” would protect against the “Human,” “Wild Game,” “Wild *Glossina morsitans*,” and “Zululand 1913” strains.

Complete cross tests were not possible as it is only exceptionally that an animal recovers from the human or other strains. The results of the experiments are set out in the conclusions.

Conclusions :—

“1. The Naturally Infected Dog strain does not protect animals from the Human, Wild *G. morsitans*, and Zululand, 1913, strains.

“2. The Wild *G. morsitans* strain and the Naturally Infected Dog strain do not protect animals from the Human or the Zululand, 1913, strain.

“3. The Wild *G. morsitans* strain does not protect against the Human strain.

“4. In spite of the damaging evidence of these experiments, the Commission still holds the opinion that the Naturally Infected Dog strain is a weak strain of the trypanosome causing disease in man in Nyasaland, *T. brucei vel rhodesiense*.”

- (7) GALLAGHER (G. H.). **The Transmission of *Trypanosoma brucei* of Nigeria by *Glossina tachinoides*, with Some Notes on *Trypanosoma nigeriense*.**—*Jl. Trop. Med. & Hyg.* 1914. Dec. 15. Vol. 17. No. 24. pp. 372-375.

The author records the occurrence of *G. tachinoides*, *G. palpalis*, and *G. caligenea* in the Eket district where he was in charge of the sleeping sickness camp.

T. brucei.—The trypanosome to which the author refers under this name is a polymorphic parasite shewing posterior nuclear forms. The strain was obtained by feeding 128 *G. tachinoides* upon a guinea-pig.

In the living state the parasite is freely motile, but not much change of position is observed. In stained preparations it is seen to possess the classical polymorphic morphology.

In inoculated animals the long forms predominated at first and then the stumpy and intermediate forms increased, and in cases where the infection was relatively chronic these become dominant.

There was no definite relationship regarding the number of posterior nuclear forms present.

The parasite varied from 12 to 32 microns in length.

In rats, in which the strain was kept after having been passed through two guinea-pigs, the average length of life was 35 days, with a minimum of 14 and a maximum of 59. The period of incubation ranged from 6 to 13 days.

T. nigeriense.—This was obtained by the inoculation of a guinea-pig and a monkey with cerebro-spinal liquid from a case of sleeping sickness which terminated fatally a few hours later.

Parasites were never numerous in the blood of these animals.

Three guinea-pigs and a mouse inoculated respectively from the original guinea-pig and monkey had not shewn evidence of infection at the time of writing.

The short stumpy forms described by MACFIE, upon which the claim for specific identity are based, have been found in the original animals which were still surviving at the time of writing, and according to competent observers they were relatively more abundant than in any strains of *T. gambiense*. A claim is therefore made for the retention of the name *T. nigeriense*.

- (8) BRUCE (D.), HAMERTON (A. E.), WATSON (D. P.), & Lady BRUCE. **Morphology of Various Strains of the Trypanosome causing Disease in Man in Nyasaland: The Human Strain (continued).**—VI to X.—*Proc. Roy. Soc.* Sept. 15. 1914. Series B. Vol. 88. No. B 602. pp. 190-205.

The authors have already published an account of the morphology of five strains of human trypanosomes (see this *Bulletin*, Vol. 1, p. 205), and in the present communication a further set of five is dealt with.

In three instances the trypanosomes were inoculated direct from the infected natives into rats, and in the remaining two instances the strains were passed through a single monkey before the rat was inoculated. The measurements were made in each case from preparations of the rat's blood.

Tables are given showing the maximum, average and minimum length of 500 trypanosomes of each strain, the distribution in respect

of length, the percentage of posterior-nuclear forms, and the average, the maximum, and the minimum breadth of the trypanosomes. A curve based upon the measurements obtained is also given in each case.

From the figures given the following details may be gathered: The average length of the five strains of trypanosomes ranged from 21.2 to 23.5 microns, the maximum length from 32 to 34, and the minimum length from 14 to 17 microns.

The figures showing the percentages of posterior nuclear forms indicate a considerable variation in this respect, ranging from 5.0 to 28.6.

With regard to the breadth of the trypanosomes belonging to the different strains there was very little variation, the average ranging from 2.56 to 2.71, the maximum from 4.5 to 5.0, and the minimum being in every case 1.25 microns.

Six experiments were made to show by means of inoculation with a single trypanosome that a single species was being dealt with. In three instances a positive result was obtained, a rat inoculated with a single long slender trypanosome developing in its blood all the forms found under natural conditions.

The following conclusion is drawn:—

“These five further strains of this trypanosome, isolated from five natives in Nyasaland, belong to the same species, *Trypanosoma brucei* vel *rhodesiense*, the trypanosome causing disease in man in Nyasaland.”

- (9) BRUCE (D.), HAMERTON (A. E.), WATSON (D. P.), & Lady BRUCE. **The Trypanosome causing Disease in Man in Nyasaland: The Liwonde Strain. Part I—Morphology. Part II.—Susceptibility of Animals.**—*Proc. Roy. Soc.* 1914. August 27. Series B. Vol. 88. No. B 601. pp. 97–111, with 5 charts.

The strain described in this paper was obtained in the Upper Shire Valley about 100 miles south of the “Proclaimed Area,” at a place where no cases of disease in man had been observed up to that time. Subsequently a case was discovered at Mpimbi, about 50 miles further south. The strain was taken to Kasu in dogs, and subsequently passed into rats and other animals, but for the purposes of studying the morphology of the parasite only trypanosomes from rats were used.

The parasites were measured in the manner adopted by Bruce, and charts based upon the measurements and distribution of the parasites according to their size were constructed. Tabulated statements also show the effects of the three strains when injected into animals of different species.

The following conclusions are drawn:—

“1. The three wild *G. morsitans* strains from the Liwonde district resemble each other closely, and all belong to the same species of trypanosome.

“2. The Liwonde strain belongs to the same species as that occurring in man, wild game, and wild *G. morsitans* inhabiting the ‘Proclaimed Area,’ Nyasaland—*T. brucei* vel *rhodesiense*.

“3. Hence it would appear that wild *G. morsitans* occurring in a district 100 miles south of the ‘Proclaimed Area’ are infected with the trypanosome which causes the human trypanosome disease of Nyasaland.”

- (10) BRUCE (D.), HAMERTON (A. E.), WATSON (D. P.), & Lady BRUCE. **The Trypanosome causing Disease in Man in Nyasaland. II. The Wild-game Strain. III. The Wild *Glossina morsitans* Strain. Part II. —Susceptibility of Animals.—***Proc. Roy. Soc.* Sept. 15. 1914. Series B. Vol. 88. No. B 602. pp. 205–212.

The previous papers dealing with the morphology of these two strains are abstracted in this *Bulletin*, Vol. 1, pp. 270 and 271.

In the present communication the effects of the strains upon animals are set out in tabular form and comparisons are instituted between them and also between them and the human strain.

The results obtained are collected into the following table :—

The average duration in days of the wild-game, wild *Glossina morsitans*, and human strain of the trypanosome causing disease in man in Nyasaland, in regard to their virulence towards various animals.—

Strain.	Ox.	Goat.	Monkey	Dog.	Rabbit.	Guinea-pig.	White rat.
Human	134	42	26	34	28	67	30
Wild game . .	—	46	38	41	—	—	32
Wild <i>G. morsitans</i>	Rec.	54	38	29	47	81	26

A further table compares the percentages of recoveries in the different species inoculated with the three strains. In the case of the human strain 80 per cent. of the cattle inoculated recovered, but there were no recoveries among the other species of animals inoculated. There were no recoveries from inoculations with the wild-game strain. With the wild *G. morsitans* strain, all the cattle, six per cent. of the goats, seven per cent. of the monkeys, and four per cent. of the dogs, recovered.

The conclusions are as follows :—

“ 1. The pathogenic action on various animals of the Human strain, the Wild-game strain, and the Wild *G. morsitans* strain is so much alike, that it may be concluded that they all three belong to the same species of trypanosome.

“ 2. This species is *T. brucei* vel *rhodesiense*, the trypanosome causing disease in man in Nyasaland.”

- (11) MACFIE (J. W. Scott) & GALLAGHER (G. H.). **Sleeping Sickness in the Eket District of Nigeria.—***Ann. Trop. Med. & Parasit.* 1914. Dec. 15. Vol. 8. No. 3. pp. 379–438. With 5 plates, one text-figure, one map, and two appendices.

The existence of the disease was first suspected in 1906, and the first case diagnosed by the discovery of the trypanosomes was in 1912.

Clinically the disease is much milder than that occurring in the Congo and Uganda. A brief description of the physical and meteorological conditions of the district is given and it is mentioned that sheep, goats, and dogs are commonly met with, and that a few dwarf cattle are also found. Larger cattle and horses are unknown. The density

of the population (about 250 per square mile) explains the almost complete absence of game. Small antelope and occasionally elephants may be found, and in some places monkeys are common.

Biting flies are fairly numerous. Tabanidae are abundant on the Qua Iboe River and *Chrysops dimidiata* has been found in a number of places. Tsetse flies have a wide distribution but occur in small numbers only.

The centre of the sleeping sickness area is at Ikotobo, and the commonest species of tsetse fly there is *G. tachinoides*. It is pointed out that this species is especially easy to get where there are pigs. The pig, however, is considered an unclean animal, possibly on account of the association with flies, and is forbidden by the native law, but the law is evaded.

Diagnosis was difficult because clinically the disease was very mild, and because trypanosomes were very difficult to detect.

Microscopic examination of thin and thick blood smears, and of smears of gland juice obtained either by puncture or by incision was resorted to. Experimental inoculation was practically impossible as experimental animals were difficult to obtain (monkeys were unobtainable), and also the trypanosome has a low degree of virulence and sometimes fails to infect guinea-pigs.

In no case were trypanosomes found in the peripheral blood, and in a large number of cases examination of gland juice also proved negative.

The symptoms of the disease are summarised.

In view of the difficulty of discovering the trypanosome and of the fact that spontaneous recovery appears to occur, it is difficult to gauge the value of treatment, but a weekly intramuscular injection of 6 grs. of atoxyl appears to be well tolerated. The presence of inter-current diseases such as malaria also complicates matters.

The trypanosome is of very low virulence for experimental animals. The white rat appears to be refractory and only a proportion of guinea-pigs inoculated with materials containing trypanosomes become infected (one out of seven). Five cubic centimetres of blood from a proved case of the disease failed to infect a guinea-pig. In the single positive guinea-pig, trypanosomes were first seen on the 27th day, and they remained very scanty for about a week, but they then increased slightly in numbers although they were still rare. The presence of short thick parasites which the authors believe to be characteristic of the strain was detected.

In view of the scantiness of trypanosomes in the enlarged glands and their absence from the peripheral blood, a difficulty arises to explain the infection of the fly. It is suggested that the human infection must depend upon a cycle of development including an insect and another animal host which has not yet been identified, the trypanosome losing virulence in the human host. In this connection attention is drawn to BRUCE's observation that *T. simiae* lost its virulence for the monkey after passage through the goat.

G. tachinoides was found to harbour *T. pecaudi* (*T. brucei* Uganda), *T. vivax*, and *T. pecorum*, and possibly also *T. nigeriense*, but the insusceptibility of experimental animals to this trypanosome prevented any actual evidence of this being obtained.

The authors were unable to obtain any wild animals for examination as game is very scanty, but in sixteen domestic animals, viz., four sheep, four goats, two dwarf cattle, four dogs, and two pigs *T. nigeriense* was not found. The dwarf cattle were found to harbour a parasite resembling *Theileria parva*, but no symptoms of illness were observed.

Appendix I by EAKIN (W. C. W.) contains a summary of the views held by the natives regarding the disease.

In the second appendix, by Macfie, are given the details of six experiments in which wild *G. tachinoides* were fed upon healthy animals with the object of discovering what species of trypanosomes may be transmitted by this fly. The results showed that *T. pecaudi* (*T. ugandae*), *T. pecorum* (*T. congolense*), and *T. vivax* are transmitted by *G. tachinoides*.

- (12) OGAWA. *Étude Morphologique et Biologique sur Trypanosoma pecaudi*. [Morphological and Biological Studies of *Trypanosoma pecaudi*.]—*Ann. Inst. Past.* 1914. July. Vol. 28. No. 7. pp. 677-691. With 7 curves and 1 text-fig.

The strain used in these investigations was one brought from Dahomey in 1908 and since maintained in guinea-pigs.

In guinea-pigs the course of the disease varied from eight to 20 days, with an average of 16. The period of incubation was two to six days. In the mouse the disease runs a more rapid course, death occurring on an average on the sixth day.

In guinea-pigs a crisis occurred which lasted from one to three days, during which period trypanosomes were not discoverable in the blood. No crises occurred in the mice.

Long slender forms and short stumpy ones were observed in all the experimental animals.

In the fresh state the parasite is very actively motile, the motility often involving considerable translation. In stained films posterior nuclear forms have been observed, and in one instance the nucleus was posterior to the blepharoplast.

The long slender parasites first appeared in the blood, and were followed by the short stumpy forms. The latter steadily increased in number for a time, and then the long forms again appeared to predominate just before death.

Numerous tables and charts are given showing the measurements of the trypanosomes and their proportional distribution, and attention is drawn to the great variability of form of curves obtained.

Serum obtained from infected guinea-pigs during crises was found to have a protective action, in that it prolonged the period of incubation when mixed with infective blood and allowed to remain in contact with it for a variable length of time before the mixture was injected into a test animal.

Attempts to cultivate the trypanosome failed, although they retained their vitality in some cases for several days in the culture media. These persistent trypanosomes were, however, found to be avirulent.

- (13) LAVERAN (A.) & ROUDSKY (D.). De l'Inoculabilité du *Trypanosoma lewisi* au Loir (*Myoxus glis*). [The Inoculability of *T. lewisi* for the Dormouse *Myoxus glis*.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8-9. pp. 654-657.

In a previous communication (see this *Bulletin*, Vol. 2, p. 131) the authors published their observations regarding the infection of a number of species with *T. lewisi* and *T. duttoni*, and they drew special attention to the facts that the infections produced were always of short duration and that they could not be transmitted in series of any species.

The authors have had the opportunity of carrying out a series of similar experiments with a number of loirs* received from Italy. They are only very rarely found in France.

In the course of their experiments they found that the loir is refractory to *T. duttoni*, but susceptible to *T. lewisi*. They further found that *T. lewisi* could be transmitted in series in the loir. The course of the infections did not exceed four or five days, but trypanosomes were sometimes present in the blood in considerable numbers.

Recovery from the infection left the animals with a degree of immunity which enabled them to resist re-infection for a period of six weeks. Lack of animals prevented further experiments.

Attention is drawn to the fact that the lerot, which is closely allied to the loir, is far less susceptible to *T. lewisi*, and, as already stated, the loir was found to be resistant to *T. duttoni*, which is so closely allied to *T. lewisi*.

- (14) LAVERAN (A.). L'Immunité que confère souvent aux Caprins une Première Atteinte de Trypanosomiase peut-elle être transmise héréditairement? [The Possible Hereditary Transmission of the Immunity sometimes conferred upon Goats by an Attack of Trypanosomiasis.]—*Bull. Soc. Path. Exot.* 1914. Dec. Vol. 7. No. 10. pp. 724-730.

The experiments detailed in this paper were carried out with the object of ascertaining whether, in countries where trypanosomiasis occurs, an advantage would attach to the use of animals that had acquired immunity.

During the last two years a number of observations have been made on the kids of goats which the author has used in some of his experiments regarding trypanosomiasis. Full details of these six experiments are given in the paper, and are summarised as follows:—

(1) A goat which had recovered from a severe infection with surra, and which was immune against the disease, gave birth to a kid which died shortly after birth. Blood collected from the heart of the kid immediately after death yielded a serum which was quite inactive when mixed with the virus of surra.

(2) A goat which had acquired immunity against surra gave birth to a kid which was inoculated with *T. evansi* 26 days later. The kid

* The loir is the large European dormouse (*Myoxus glis*); the lerot is smaller and belongs to Southern Europe and Northern Africa (*Eliomys*; several species).

became infected. At an interval of 71 days after inoculation, the animal died with suppurative arthritis, which did not appear to have any connection with the trypanosomiasis.

(3) A goat which was immune to surra and debab gave birth to two kids. One of these was inoculated a month after birth with the virus of debab. It became infected, and the disease ran a normal course. The other, which was inoculated with the virus of surra six weeks after birth, also became infected, the disease following a normal course.

(4) A goat which had recovered from infection with *T. gambiense* gave birth to two kids. One of these was bled a month after birth and the serum obtained when mixed with *T. gambiense* was found to be inactive. This kid became infected on two occasions when inoculated with *T. gambiense*.

(5) A goat which had acquired an immunity to *T. congolense* gave birth to a kid which became infected when inoculated with this trypanosome 16 days after birth. The disease took a chronic course and terminated fatally.

(6) A goat which had acquired an immunity to *T. congolense* gave birth to three kids. One of these was inoculated 43 days after birth with *T. congolense*. Infection resulted and the disease took a normal course.

The conclusion to be drawn is that animals which have acquired immunity are not specially suitable to breed from, in infected countries.

- (15) CIUCA (M.). **Sur l'Action Protectrice et Immunisante du Sérum des Animaux Trypanosomés traités à l'Emétique de Potassium.** [The Protective and Immunising Properties of the Serum of Animals infected with Trypanosomes after Treatment with Potassium Tartrate.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8-9. pp. 670-677.

The author's experiments have been carried out with rabbits, guinea-pigs, and rats, both healthy and infected with the Uganda strain of nagana. For rabbits and guinea-pigs the intravenous administration of the drug has been employed, while rats were treated by intraperitoneal injection, either distilled water or physiological salt solution being used for dissolving the drug.

The trypanocidal effects of the sera of infected animals were tested by mixing them with varying proportions of citrated blood from infected mice, while their protective properties were tested by injecting these mixtures into healthy mice subcutaneously. It was found that the serum albumins of a healthy animal did not alter the power possessed by solutions of emetic ranging from 4 per 1,000 to 1 in 20,000 of rendering trypanosomes motionless and also that stronger solutions than 1 per 1,000 produced slight haemolysis both *in vitro* and *in vivo*.

The blood of animals treated with emetic was found to coagulate more slowly than normal blood.

Guinea-pigs were treated with doses of emetic ranging from 1 to 9 mgm. per 100 grams body-weight on the fourth day after the appearance of trypanosomes in their blood. The latter dose is toxic, and generally causes death within an hour. Five minutes after the injection, blood

withdrawn from the animals failed to set up infection in healthy mice. On the other hand, there was found to be no difference in the effects of serum obtained from infected animals after treatment, and serum from infected guinea-pigs which had not been treated, normal guinea-pigs which had been treated and those which had not, when tested *in vitro*. Not only was there no trypanocidal effect, but the trypanosomes actually retained their power of movement better than in mixtures of infected mouse blood and salt solution or citrate solution.

In another series of experiments the dose of emetic was increased to 12 mgm. per 100 grammes, the animals being bled 5 minutes later. The red and white corpuscles were separated from each other and from the serum and extracted in isotonic salt solution for 24 hours.

Even in these cases neither the serum nor the extracts had any immobilising effect upon the trypanosomes *in vitro*.

It was found that when the emetic was added to the blood, after withdrawal of the latter, the serum and the extracts of the corpuscles caused a very pronounced effect upon trypanosomes, all movement ceasing in less than 5 minutes.

The author also carried out a number of experiments with salvarsan and atoxyl, and the results obtained confirmed those of LEVADITI and MUTERMILCH.

(16) BRUCE (D.). Classification of the African Trypanosomes Pathogenic to Man and Domestic Animals.—*Trans. Soc. Trop. Med. & Hyg.* 1914. Nov. Vol. 8. No. 1. pp. 1-22.

The author refers to the risks attaching to attempts to classify trypanosomes from the examination of strains which have been maintained for varying lengths of time in laboratories. As an example of this he instances *T. brucei*, which he says has become monomorphic, and quotes ROUBAUD to the effect that it has lost the power of developing or even surviving in the tsetse fly.

With two exceptions—viz., *T. evansi* and *T. equiperdum*—the author has worked in the field with all the trypanosomes referred to in the paper.

The classification is based upon a consideration of three characters of the trypanosomes, their morphology, their action upon animals, and their mode of development in the fly. Simplicity of classification is the author's aim, and he rejects cross-inoculation and serum diagnosis as means of identification as tending to multiply species.

The author refers to the desirability of the adoption of some standard method of studying and describing trypanosomes.

The biometric method of measurement has not yielded the results hoped for, but it is nevertheless considered as a useful means of expressing the "distribution of length" in a given species. It is advised that 1,000 trypanosomes in batches of 100 on consecutive days should be measured to supply data for the construction of a curve, a number of susceptible animals being used for the purpose, or that 1,000 trypanosomes taken at random from various susceptible animals should be drawn and measured, and that, where practicable, 100 trypanosomes from a single white rat on 10 consecutive days should be measured.

Breadth should be measured across the thickest part, including the undulating membrane.

Coloured drawings should always be included and the morphological details accurately described.

With regard to the susceptibility of animals, one must proceed with caution, as there are known instances of profound change in virulence of trypanosomes for given species under certain circumstances. For example, *T. brucei* may be rendered capable of killing white rats in two days after a long series of passages through that species. On the other hand, *T. simiae*, which when obtained from the fly kills monkeys in 10 days, becomes avirulent for the monkey after a single passage through the goat.

Cross-inoculations are difficult to carry out in the field, as immunised animals are not always available and errors may result from variation of virulence in laboratory strains.

Serum diagnosis presents great difficulty in the field owing to the impossibility of keeping a number of small animals.

In the author's classification three main groups are formed:—

A.—The *T. brucei* group. This comprises the polymorphic parasites, which make it possible to separate the parasites contained in it from the other groups by morphology alone. Two of the parasites included in this group develop in the gut of the fly and then pass to the salivary glands, where they complete their development.

B.—*T. pecorum* group. The parasites included in this group are all small and monomorphic. The development takes place in the intestine and proboscis, but the salivary glands are not invaded.

C.—*T. vivax* group. The trypanosomes of this group are monomorphic and very active. Development takes place in the labial cavity and hypopharynx, but not in the intestine or salivary glands.

Group A. comprises:—

- (1) *T. brucei* Plimmer and Bradford.
Synonyms: *T. rhodesiense* Stephens and Fantham.
T. ugandae Stephens and Blacklock.
- (2) *T. gambiense* Dutton.
Synonym: *T. nigeriense* Macfie.
- (3) *T. evansi* Steel.
Synonym: *T. soudanense* Laveran.
- (4) *T. equiperdum* Doflein.

Group B.:—

- (1) *T. pecorum*.
Synonym: *T. confusum* Kinghorn and Montgomery.
T. nanum Laveran.
- (2) *T. simiae*.
Synonym: *T. ignotum* Kinghorn and Yorke.

Group C.:—

- (1) *T. vivax* Ziemann.
Synonym: *T. cazalboui* Laveran.
- (2) *T. caprae* Kleine.
- (3) *T. uniforme*.

- (17) SEIDELIN (H.). Notes on the Antagonistic Relations between Trypanosomes and Blood Elements.—*Jl. Path. & Bact.* 1915. Jan. Vol. 19. No. 3. pp. 315-316. With 1 plate comprising 8 figures.

The author describes briefly a process of ingestion of red corpuscles by trypanosomes which he has observed in stained and fresh preparations. The figures are taken from photographs of the various stages of the process as observed in a single preparation of the blood of a rat infected with a trypanosome of the *lewisi* type. The phenomenon is said to be uncommon, but, should it prove to be more common than it at present appears to be, it would be of importance as an anaemia-producing factor.

LEISHMANIASIS.

- (18) LAVERAN (A.). Les Leishmanioses chez les Animaux. [Leishmaniasis in Animals.]—*Ann. Inst. Past.* 1914. Sept.-Oct. Vol. 28. No. 9-10. pp. 823-838.
ii. *Ibid.* Nov.-Dec. No. 11-12. pp. 885-912.

i. This paper is a summary of the present state of knowledge regarding Leishmaniasis in the dog. In subsequent papers the following conditions are to be dealt with: Experimental infections produced by *L. infantum*, and *L. donovani*, and natural and experimental infections with *L. tropica*.

Natural infection in the Dog.—

A historical survey is given from the discovery of the condition by NICOLLE and COMTE in 1908, the distribution of the disease being simultaneously dealt with.

The clinical aspect of the disease is referred to, and the views held by different authors regarding the identity or otherwise of the canine disease with human leishmaniasis are summarised. The author concludes that "the probabilities appear to be in favour of the identity of *L. infantum* and the *Leishmania* that is responsible for natural infections in the dog." It is admitted that there are certain difficulties in the way of accepting this view. The principal objections are:—the inconstant association of the canine disease and the disease in children; the rare discovery of the canine disease in houses where there are human patients; and the failure to find cases of the disease in dogs in India, if the Indian and the Mediterranean disease are identical, as seems probable.

The views of a number of authors regarding the methods of transmission of the parasite are briefly referred to, and the conclusion arrived at by the author is that the real manner of transmission has not yet been definitely discovered.

Diagnosis can only be based upon the discovery of the parasite, and where these are scanty, cultivation should be resorted to. The tubes of medium (simplified Novy) must be incubated at 22° C. for at least a month before being considered as negative.

During life puncture of the liver may be resorted to. To achieve this the puncture must be made in the 10th intercostal space, one or two fingers' breadth from the summit of the dorsal spines. This

method only succeeds when parasites are numerous. The femur may be trephined on its outer face for the taking of material for examination. It is probable that recovery frequently occurs in the dog, but no method of treatment is known.

ii. The effects of inoculation with *L. infantum* in different species.—

The parasite is transmissible by inoculation to the dog, monkey, mouse, rat, and with less ease to the guinea-pig and rabbit. It is preferable to inoculate into either the peritoneum or the liver; a considerable dose should be given. Subcutaneous inoculation generally fails. Inoculations with cultures containing the flagellate stage of the parasite are less successful than inoculations with the parasite as it occurs in the body. The parasites lose virulence under cultivation. Although young dogs are generally more easily infected than old ones, this is not always the case. The parasite can be carried on in series in dogs. The symptoms in dogs may be very slight, and a diagnosis can only be made by the discovery of the parasite. Spontaneous recovery may occur and immunity may be thereby acquired, but if a dog be re-inoculated before recovery is complete, a more severe infection often results.

The author gives a summary of 25 successful inoculations, some of which were made in Tunis by NICOLLE and some by himself in Paris.

In infected dogs the spleen is enlarged, the bone marrow is often red and diffuent, but the liver presents a normal appearance. The parasites are generally more numerous in the bone marrow than in the spleen.

The facts with regard to the experimental infection of monkeys closely resemble those already referred to in the dog. Contrary to what might be supposed, passage through monkeys produces no exaltation of virulence but a rapid attenuation. In monkeys the symptoms are more pronounced than in dogs.

In mice inoculated intraperitoneally the infection sometimes remains restricted to the peritoneum, but in other cases it becomes generalised. As with the other species referred to, inoculation with cultures of the flagellate generally fails, the parasites being promptly destroyed by phagocytes.

Inoculation of guinea-pigs fails more generally than it succeeds, and the same holds good for the rabbit.

A single natural case of the infection in the cat has been published, but experimental infection has up to the present failed completely.

Birds, lizards, and frogs have also resisted experimental inoculation.

(19) ARCHIBALD (R. G.). A Preliminary Report on Some Further Investigations on Kala Azar in the Sudan.—*Jl. R. Army Med. Corps.* 1914. Nov. Vol. 23. No. 5. pp. 479-495.

Inoculation experiments have shown that the following animals are susceptible to infection with kala azar:—The grey monkey, *Lasiopyga callitrichus* (*Cercopithecus sebaeus*), the jerboa (*J. gordonii*), the gerbil (*G. pygargus*), and young dogs.

In the gerbil and jerboa the infection runs a chronic course and does not appear to disturb the health of the host.

Negative results were obtained with the guinea-pig, rabbit, cat, a cheetah, and pigeons.

Cultural experiments.—

The parasite grew readily on N.N.N. medium, and cultures were also obtained on ox blood serum and Buchanan's medium containing 1 per cent. neutral red.

Sheep blood in the place of rabbit blood in the N.N.N. medium was found to inhibit growth of *Leishmania donovani*, but not of *L. tropica*. Aerobic cultures were slightly more luxuriant than cultures put up under anaerobic conditions.

From the results obtained in a number of experiments in which cultures of varying age were subjected to special conditions such as exposure to sunlight, varied temperatures, dilute solution of hydrochloric acid, tap, distilled, and river water, it was inferred that the cultural forms of the parasite possess greater vitality than they are generally credited with. Under unfavourable conditions the tendency is to revert to the cystic stage.

A few experiments designed to show whether specific agglutinins were present in the blood of infected persons or not indicated that there were none. A remarkable result was obtained when a six day old culture was mixed in equal volumes with normal serum from a healthy person. The parasites immediately became motionless with their flagella extended.

A single experiment in which a healthy monkey had administered to it faeces from an infected man yielded a negative result.

The spleen of a heavily infected monkey was emulsified and fed to a healthy monkey by means of a pipette, special care being taken to avoid contact of the pipette with any part of the mouth, thus eliminating the possibility of inoculation. The fed monkey was killed on the 36th day owing to great emaciation and weakness. The peripheral blood showed some normoblasts and cells showing punctate basophilia, but no parasites were discovered in any of the organs. An emulsion of the liver and spleen was inoculated intraperitoneally into a healthy monkey. When killed 123 days later this animal was found to be infected.

In a second feeding experiment, a monkey was infected by the administration of spleen emulsion from a fatal case of kala azar.

A healthy pup was fed on two occasions with material from the liver and spleen of infected monkeys. After two months the animal appeared to be emaciated and anaemic. No *Leishmania* could be found, but the liver showed oval and rounded cells containing "coccal bodies" identical with those described by SMALLMAN and the author.

The author believes these bodies to be of protozoal origin, and connected in some way with *Leishmania*.

An attempt to infect a puppy by feeding with cultures yielded a negative result, as did also an attempt to infect a monkey by introducing culture into the vagina.

An attempt to infect a monkey with culture by scarification also failed.

The disease as met with in the Sudan.—

Two forms of the disease are clinically recognisable: an acute form which is fatal within a few weeks or months, and a more chronic form where the patient may live for a year or more.

It is not possible to say from the data available whether there is any difference between the infection of adults and children. In one case in which spleen puncture failed owing apparently to fibrosis, liver puncture yielded material containing cells within which were included "coccal bodies." This patient recovered. The parasites were not seen in this case and cultures were negative, but it is pointed out that this is the third case in which the "coccal bodies" have been found in patients showing all the symptoms of kala azar who have recovered.

A patient showing marked enlargement of the liver and spleen associated with diarrhoea was given several injections of a vaccine prepared from a six day culture, and a sensitised vaccine was also administered. Improvement associated with decrease in size of the liver and spleen resulted, and although the spleen has not returned to the normal size there is a complete absence of fever, and at the time of writing the patient is in fairly good health.

A number of facts which appear to negative the theory that the disease is transmitted by biting insects are set down, and these may be summarised as follows:—

The disease is very uncommon among females who, in view of their mode of living, are especially liable to the bites of insects and bugs. As a rule only a single individual is attacked in a hut, while animals of various kinds which also have free access to the huts have not been found to be infected.

The high percentage of cases in which the parasite is present in the peripheral blood when compared with the distribution of the disease contra-indicates insect transmission.

The disease has not been found in an epidemic form in the Sudan.

There is no evidence of development of the parasite in lice, fleas, or bugs, and experiments with these have yielded negative results only.

Experiments *in vitro* with human serum on cultures, furnish presumptive evidence against the survival of the parasite after entering the human subject by way of the skin.

Attempts to infect *L. callitrichus* by scarification have failed.

In the author's opinion evidence is accumulating which suggests that infection may be by way of the alimentary tract. It is possibly taken in with water or with some intermediate host in the water. Recently some investigations have been made with a species of cyclops taken near Khartoum and flagellates have been found in their intestinal tract. The possibility must therefore be considered whether such crustaceans may be intermediate hosts of such parasites, as they are for such protozoa as entamoeba and trichomonas.

A large number of animals, including dogs, sheep, goats, chickens, cats, squirrels, lizards, pigeons, bats, guinea-fowls, crocodiles, hyaenas, and various species of gazelles have been examined with negative results.

- (20) PATTON (W. S.). **The Examination of the Peripheral Blood of 84 Patients, suffering from Kala-Azar at the General Hospital, Madras, during the Period from 15th June 1912 to 15th July 1913.**—*Indian Jl. Med. Research.* 1914. Oct. Vol. 2. No. 2. pp. 492-504.

The bulk of this paper consists of a tabulated statement giving brief details of each of the 84 cases.

The method of diagnosis adopted was as follows: Films were made of peripheral blood so that as many as possible of the leucocytes were collected at the ends and sides of the smears. These were stained deeply with Romanowsky and searched, preferably with a dry lens, for parasites. It is said that the parasites were usually discoverable within a few minutes. Two films were made each morning. Examination of the records yields the following information.

The parasite was found in the	1st film in 42 cases.
” ” ” ” ”	2nd ” 13 ”
” ” ” ” ”	3rd ” 12 ”
” ” ” ” ”	4th ” 5 ”
” ” ” ” ”	5th ” 2 ”
” ” ” ” ”	6th ” 4 ”
” ” ” ” ”	7th ” 1 ”
” ” ” ” ”	8th ” 1 ”
” ” ” ” ”	9th ” 2 ”
” ” ” ” ”	17th ” 1 ”
” ” ” ” ”	20th ” 1 ”
	Total .. 84

- (21) NICOLLE (C.) & CHATTON (E.). *Longue Conservation de la Virulence pour l'Homme de la Leishmania tropica, en Cultures.* [The Long Retention of Virulence for Man of *L. tropica* in Culture.]—*Bull. Soc. Path. Exot.* 1914. Dec. Vol. 7. No. 10. pp. 700-702.

One of the authors has infected himself with a strain of the parasite isolated in 1909 and since passed through 115 generations on simplified Novy medium. The inoculation was made by means of a syringe into the thickness of the skin of the forearm and the culture used was thirteen days old.

- (22) LAVERAN (A.). *Infections Expérimentales de Souris, d'un Merionés, d'un Rat et d'un Macaque par la Leishmania tropica.* [Experimental Infections of the Mouse, Merion, Rat, and Macacus with *Leishmania tropica*.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8-9. pp. 663-670. With 2 figs.

The author's experiments have been carried out to check those published by GONDER regarding the inoculability of the mouse with *L. tropica*. He has used a strain of the same origin as that used by GONDER, viz., one obtained from the Pasteur Institute at Tunis and, as recommended by Row, has used cultures about a month old and not recent ones.

The lesions developing in infected males are thus described:—About the fourth month the testicles become swollen and indurated, and liquid obtained by puncture contains numerous parasites. Little superficial lesions make their appearance on the skin of the scrotum or tail, and the latter may be completely destroyed. Enlargement of the spleen was seen in every case but parasites were not discovered in it, nor were they found in either the liver or the bone marrow.

A female mouse which was successfully infected showed a lesion on the abdominal wall closely resembling oriental boil, and there was also a generalised infection. Parasites were present in large numbers in this lesion, as also in the liver. They were present in moderate numbers in the spleen, but scanty in the bone marrow.

In addition to mice, of which six out of twelve were successfully inoculated, the author has infected one out of three merions* caught in Tunis. In this case lesions exactly like those found in the male mice commenced to develop about the fifth month. As in the case of the mice, there were no parasites discoverable in the liver, spleen, or bone marrow.

A rat inoculated into the testicle with material derived from one of the infected mice developed a local lesion only. A similar result followed the inoculation of a rat direct into the testicle with culture of the same parasite.

A macacus monkey, inoculated with material derived from an infected mouse, showed little nodular skin lesions after an interval of about nine days. This virus was more active than that of Delhi sore with which some of the author's earlier experiments were made, but the lesions produced very much resembled each other.

While the author does not feel justified in drawing any conclusion from the results of these experiments he states that they appear to contra-indicate the identity of *L. infantum* and *L. tropica*.

SPIROCHAETOSIS.

(23) FANTHAM (H. B.). *The Granule Phase of Spirochaetes.*—*Jl. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3. pp. 471-484.

In this paper an attempt is made to throw light on the much-discussed subject of the granule phase of spirochaetes and in it are incorporated results of the author's recent work.

The conclusions arrived at may be summarised as follows:—

(1) The formation of granules from spirochaetes is generally admitted, their significance only being in dispute.

(2) Danger attaches to generalisation, as it has never been asserted that all the granules seen in the tissues of infected ticks were of spirochaetal origin.

(3) The author has seen granular structures in various tissues of the ticks similar to those figured by MARCHOUX and COUVY, but often they were not so marked as represented in the figures of those authors.

(4) The full details of climatic conditions, especially humidity and temperature under which the experimental ticks were kept, must be recorded.

(5) The view is expressed that MARCHOUX and COUVY's postulate of ultra microscopic spirochaetes is weak.

(6) Small spirochaetes have been seen to emerge from granules contained in tissues from ticks by the use of dark ground illumination.

* *Meriones*: a genus of *Muridae*.

(7) There is evidence to show that granules grow into spirochaetes *in vitro*.

(8) The author has observed the formation of granules (coccoid bodies or spores) from *Spirochaeta bronchialis*. The spirochaetiform phase of this parasite dies rapidly outside the body.

(9) SERGENT and FOLEY have shown that the spirochaete of relapsing fever in North Africa possesses a small but virulent form which is assumed during apyrexial periods in man, and during a period following an infecting meal in the louse.

PROTOZOA.

(24) MACFIE (J. W. Scott). Notes on some Blood Parasites collected in Nigeria.—*Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3. pp. 439-468. With 2 coloured plates and 1 text fig.

This paper is divided into six sections dealing with the following:—

(1) The occurrence of babesiasis in domesticated animals in Nigeria; (2) A spirochaete found in the blood of a guinea-pig; (3) Bacilliform bodies found in the red corpuscles of a rat; (4) A disease of fowls characterised by inclusions in the leucocytes; (5) Blood parasites of lizards and toads; (6) The occurrence of a spirochaete in the gut of *G. tachinoides*.

(1) Fifteen goats, seventeen Hausa cattle, two dwarf cattle, and twenty-five sheep were examined for intra-corpuscular blood parasites, and they were detected in two Hausa cattle, two dwarf cattle, and eleven sheep.

No evidence was available that the animals had shown any symptoms of illness. The blood was taken from animals about to be slaughtered.

In most cases the parasites were numerous. The description of the morphology of the parasite and the coloured illustration of it, indicate its close resemblance to *Theileria parva*, as stated by the author. But a form is figured and described which exactly agrees with the "maltese-cross" form of *Nuttallia equi*.

"Blue bodies" were not found, but apparently only blood smears were examined.

An attempt was made to cultivate the parasite, 1-10 cc. of 50 per cent. glucose solution being added to 8 cc. of defibrinated blood, the tubes being incubated at 37° C. For the experiment the blood of an infected ram was used. Parasites were fairly numerous in the blood and "dividing forms" did not exceed 4 per cent.

After six hours incubation "dividing forms" numbered 19 per cent., and at 24 hours there were 21 per cent. of these forms.

Parasites appeared to maintain their full vitality up to 90 hours, after which they seemed to decrease in numbers.

One of the Hausa cattle was also found to be infected with a *Babesia*. These were much larger parasites. Only two imperfect films were available for examination.

Extra-corpuseular forms containing a large mass of chromatin and a solid looking cytoplasm were found, but intra-corpuseular forms showed irregular shaped bodies with, in some cases, as many as six or seven pieces of chromatin. It is suggested that this may possibly be a new species.

In one of the dwarf cattle a parasite apparently identical with *B. bigeminum* was found.

Babesiasis in guinea-pigs.—Two babesia-like parasites have been found in these animals. They have been known to be present in the blood of an animal for months without producing any symptoms.

Paraplasma flavigenum.—This is said to resemble closely some of the forms of *Theileria parva*. It is indistinguishable from *Paraplasma flavigenum* in human blood taken from people infected with yellow fever and in the blood of guinea-pigs inoculated from such cases. In view of the endemicity of yellow fever in Nigeria the possibility is suggested that the presence of the parasite in the guinea-pig represents a natural infection.

The second parasite found in guinea-pigs resembles *Paraplasma flavigenum* but is coarser in structure and invariably causes a "stippling" of the invaded cell.

The coarseness of this "stippling" appeared to be dependent upon the intensity of the strain.

A heavily infected guinea-pig remained apparently healthy for five months, the parasites varying in number from day to day.

The name *Paraplasma cobayae* is suggested for this parasite.

(2) Spirochaete in the blood of a guinea-pig.—This organism was fortuitously isolated from the blood of a guinea-pig with which experiments were being made for the cultivation of *Paraplasma flavigenum*.

Bass's method was used and spirochaetes appeared after 46 hours incubation at 37° C. They increased up to the 79th hour when they were innumerable. All spirochaetes had vanished by the 8th day.

The parasites ranged from 2 to 9 microns in length, with exceptional ones measuring 14 microns; they showed from two to six undulations, and had blunted ends.

The parasites were still capable of multiplying on transplantation at the 100th hour, although they had undergone marked structural changes.

(3) Bacilliform bodies found in the red corpuscles of a rat.—At the time of writing the author had not had the opportunity of consulting recent literature, but since doing so he is convinced that the bodies which he saw in the blood of a rat were *Grahamella*.

(4) Disease of fowls characterised by inclusions in leucocytes.—This condition appears to be well known among the natives.

Symptoms.—The earliest symptom is that the infected bird stands still with its head and tail drooping, then the wings begin to droop and the bird becomes unsteady, standing with its legs wide apart. Finally it falls and remains motionless until death occurs. Diarrhoea is a marked symptom. There is not constantly any anaemia. Death generally occurs in two days.

Examination of the blood revealed the presence of chromatin granules in the cytoplasm of leucocytes. These granules varied in size and shape, the majority were large and rounded or annular, but club-shaped and signet forms occurred. Similar bodies were found in great numbers in the cells in smears from the liver and spleen, but they were often much larger and crowded together to form solid masses.

In the earlier stages of the condition red corpuscles were found, the nuclei of which stained of a rather brown tint with Giemsa. In the later stages the cytoplasm of such corpuscles was more or less stippled with brownish or purplish granules.

Twenty-eight toads (*Bufo regularis*) were examined. Trypanosomes were found in 4, microfilariae in 3, and haemogregarines in 8. Of 38 lizards (*Agama colonorum*) examined, one showed trypanosomes, 13 microfilariae, 2 haemogregarines, and 3 haemocystidia.

(6) A spirochaete in the gut of *G. tachinoides*.

Spirochaetes were found in immense numbers in the posterior part of the gut of a fly, which was dissected in the course of some experiments. This fly had fed on a normal guinea-pig for some days, but the animal showed no evidence of infection. The parasites varied in length from 7 to 35 microns, they were extremely slender, and their ends were blunt.

(25) BOUILLIEZ (M.). **Exposé des Travaux en Cours au Laboratoire de Fort-Archambault.** [An Outline of the Work in Hand at the Fort Archambault Laboratory.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8-9. pp. 685-694.

This report was not intended for publication, but it was thought advisable that it should be published.

Human and animal trypanosomes, with the methods of transmission, malaria, bilharziosis, and goitre are dealt with.

Human trypanosomiasis has been discovered along the course of the Bahr Sara, and it appears to have been long established there. No cases have been found along the Shari and in the valleys of Bahr Kô, except in a few villages near Fort Archambault among people who admit having lived in the infected districts of Crampel, Sibut and Bangui.

Animal trypanosomiasis.—The author has had the opportunity of investigating these more particularly in equidae, as the cattle, sheep,

and goats, of which there are large numbers in Chad, do not come quite so far south as Fort Archambault. In horses the only trypanosome found appears to be *T. pecaudi*.

A number of sheep, goats, and cattle have been examined on their way through but no trypanosomes have been detected. The author was not in a position to carry out inoculation tests for the detection of infection in these animals. *T. lewisi* is very common among rats.

Two donkeys out of 22 which were passing through, were found to be infected with a trypanosome which appeared to be *T. cazalboui*.

At the time of writing, it had not been possible to investigate the question of the species of biting flies present in the area, but *G. morsitans* and *G. tachinoides* had been discovered.

Malaria.—A small number of examinations have been made to ascertain the frequency of malaria, and the figures show a percentage of 79. The majority of the parasites were of the *P. praecox* type, but *P. vivax* and another unidentified organism have been seen.

Bilharziosis of the bladder and intestine both occur, but some transmission experiments carried out with monkeys were not complete at the time of writing.

Goitre is very common among the natives.

HELMINTHS.

(26) NICOLL (W.). On the Migration of the Larvae of *Onchocerca gibsoni* through the Capsule of the Worm Nodule.—*Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3. pp. 609-621.

The first three pages of this communication are occupied by a summary of the literature regarding this parasite.

The author's observations may be summarised as follows:—

Attempts were made to ascertain whether larvae were able to escape from the worm nodules and pass through the uninjured skin of the host and thus gain the exterior, as stated by BREINL.

In a number of experiments, pads soaked in sterile water were applied over nodules for periods ranging from 1½ to 3 hours at different times during the day, the water being subsequently examined for embryos. The results in every case were negative, as were also those in which the pads were replaced by small vessels containing water.

In further experiments carried out with nodules excised from carcasses some positive results were obtained.

Two freshly excised nodules were obtained, one of which was surrounded by muscle and the other by connective tissue. The muscle was cut away from the nodule and divided into two portions. These two portions and the two nodules were placed in separate capsules containing filtered rain water. Two of these capsules were incubated

at 37° C. and the other two were left at room temperature (21° to 26° C.). The water was replaced at frequent intervals, each change being examined after centrifuging.

The larger (incubated) nodule and the piece of muscle which had been cut from it and left at room temperature gave negative results throughout.

The incubated piece of muscle yielded one larva after 2½ hours, and the nodule which had been left at room temperature yielded two larvae at the end of 6 hours and another, 3 hours later.

In a second experiment eight nodules were used, and the following table indicated the manner in which they were treated together with the results obtained.

Experiment started at 1 p.m., 30th July.

	30th July.			31st July.	1st August.
	2.15 p.m.	5.15 p.m.	9 p.m.	9 a.m.	12 noon.
5. Acidulated water, 37° C.	4	0	2	0	0
6. Acidulated water, Room temperature..	0	3	0	0	0
7. Ammoniated water, 37° C.	2	2	0	6	1
8. Ammoniated water, Room temperature..	2	12	0	0	0
9. 37° C...	42	8	0	0	3
10. Room temperature ..	439	2,000	Very numerous.	30	7
11. 37° C.	47	18	0	0	0
12. Room temperature ..	42	230	20	14	0

When the nodules were examined after the experiment, it was found that in Nos. 5 and 6 the worm appeared as a caseous mass. In Nos. 7 and 8 the worm was in good condition, but the larvae were all dead. A similar condition was found in 10 and 12, but in 9 and 11 the interior of the nodule was in a state of putrefaction.

Nodule 12 had had made in it two cross-shaped incisions $\frac{1}{16}$ th inch deep before the experiment, but the others were not so treated. The absence of any cuts or perforations was confirmed by examination of the nodules after the experiment.

Three further series of experiments were made on much the same lines and the details are given in tabular form showing the methods of treatment and the results obtained.

These may be summarised as follows :—

The experiments go to show that *Onchocerca* larvae can escape from the nodules, usually in small numbers, but at times in comparatively large numbers.

The fact that the embryos were found to be incapable of maintaining their existence in water for more than two days must be placed against the view that the infection is water-borne, although it cannot be excluded. Water-born infection, either direct or through an intermediate host, must be considered as a possibility.

Further bias in favour of water-borne infection is the analogy between *Onchocerca* and guinea-worm. On the other hand, the adult worm is so closely allied to the *Filariæ* that insect transmission seems to present the greatest measure of probability.

If it be the case that larvae emerge through the skin of their own accord some non-biting insect might become infected, but in that case it would be difficult to explain re-inoculation.

(27) MITRA (S. B.) & GANGULY (H. C.). Canine Filariasis.—*Vet. Jl.* 1915. Jan. Vol. 71. No. 475. pp. 40–42. With 1 text fig.

The filariæ which are briefly described in this note were found in the blood of a kangaroo hound dog. Their presence was associated with a variable temperature, and they appeared to be less numerous in the morning than in the evening.

The average length of the parasites was 300 microns and they were therefore longer than *Acanthocheilonema recondita* and *A. dracunculoides*, which are said not to exceed 230 microns.

Their size places them between *Dirofilaria repens* and *D. immitis*, and the authors are inclined to identify them with the latter.

(28) SERGENT (Edm.). Première Note sur les Phlébotomes Algériens. [First Note on the Algerian Phlebotomes.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8–9. pp. 660–662.

The author gives the following list of species of *Phlebotomus* and their geographical distribution :—

Coast—

Phlebotomus papatasi Scopoli. Very common in July, August, and September.

Upper Plateaus (from 800 to 1,000 metres)—

Phlebotomus papatasi Scopoli.

„ *minutus* var. *africanus* Newstead.

„ *perniciosus* Newstead.

All these occur during the first three weeks of September only.

Sahara—

Phlebotomus papatasi (from the middle of May till October at Beni-Ounif-de-Figuig).

At Biskra *P. papatasi* and *P. minutus africanus* appear in about equal numbers, but *P. perniciosus* is more rarely seen.

- (29) LANE (C.). Suckered Round-worms from India and Ceylon.—
Indian Jl. Med. Research. 1914. Oct. Vol. 2. No. 2. pp. 655-669.
With 8 plates.

The following is a list of the parasites described in this paper:—

Heterakinae—

- Heterakis bosia*, n. sp., Tragopan pheasant.
" *putaustralis*, n. sp., Domestic fowl.
Ganguleterakis gangula, n. gen., n. sp., *Mus decumanus*.
Ascaridia hamia, n. sp., Domestic fowl.
Kathlania kathlena, n. gen., n. sp., *Chelone midas*.
" *tonandia*, n. sp. *Chelone midas*.

MISCELLANEOUS.

- (30) SEIDELIN (H.). *Klossiella* sp. in the Kidney of a Guinea-pig.—
Ann. Trop. Med. & Parasit. 1914. Dec. Vol. 8. No. 3. pp. 553-564. With 2 plates comprising 27 figures.

The parasite described in this paper has been found in the kidneys of a guinea-pig at the Medical Research Institute, Yaba, Nigeria.

To the naked eye the kidneys presented a normal appearance, and apart from the presence of the parasite in the renal epithelium the microscopic alterations were similar to those seen in many animals infected with yellow fever as was the case with this guinea-pig.

The coccidium-like parasite was found in larger or smaller numbers in every section examined.

The earliest stage of the parasite appears to be a small rounded body measuring about 2 microns in diameter with an irregular shaped nucleus and scanty cytoplasm.

The parasite increases in size until it measures about 6 microns when the nucleus begins to divide up into daughter nuclei which eventually dispose themselves at the surface of the cytoplasm. The daughter cells are formed apparently by a process of budding, and the number varies from 16 to 20. These again become divided and produce about 30 small fusiform structures, measuring about 8 microns by 1.5.

The parasites occur in the epithelium of the convoluted tubes and of the loop of Henle.

Parasites were not found in the straight tubes nor in the pelvis.

No opportunity occurred to follow up the life cycle of the parasite, as it was found in sections which were being examined in the course of other observations.

Should the parasite prove to be a new species, the name *Klossiella cobayae* is suggested.

- (31) WENYON (C. M.) & Low (G. C.). **The Occurrence of Certain Structures in the Erythrocytes of Guinea-pigs and their Relationship to the So-called Parasite of Yellow Fever.**—*Jl. Trop. Med. & Hyg.* 1914. Dec. 15. Vol. 17. No. 24. pp. 369-372. With 1 coloured plate.

This paper deals with the discovery by the authors of certain bodies within the red corpuscles of healthy guinea-pigs which appear to be identical with those described by SEIDELIN, and MACFIE and JOHNSTON, and called by them *Paraplasma flavigenum*, which they found in the red blood corpuscles in cases of yellow fever and which were said to be inoculable to guinea-pigs in series.

AGRAMONTE and SCHILLING-Torgau have already published observations of the same nature.

The bodies in question are particularly numerous in newly-born animals, and this fact contraindicates their parasitic nature, as placental transmission is exceedingly rare in parasitology. With increasing age they disappear.

It is probable that the bodies represent some of nuclear material.

In suitably stained preparations the bodies may be seen as minute red granules, one or more being present in a single cell. In some cases the red speck is associated with bluish-grey material which suggests cytoplasm. The arrangement of this material is very variable. The explanation of its presence is difficult to furnish. In some cases the bodies have a definite ring shape with a lateral red dot much like a ring form of piroplasm save that they are much smaller.

The authors believe that the bodies are real structures and not artefacts. The remainder of the paper deals with the possible connection between these bodies and yellow fever.

- (32) SMITH (A.) & MITTER (S. N.). **A Brief Note on an Outbreak of Septicaemia among the Monal Pheasants of the Calcutta Zoological Garden.**—*Vet. Jl.* 1914. Jan. Vol. 71. No. 475. pp. 37-40.

The authors believe that the disease responsible for the deaths of the pheasants was identical with that described by GAMALIA in 1888 as occurring among fowls in Southern Russia.

They isolated an organism which agreed in its morphological and cultural characters with the *Vibrio metchnikovi*.

In experimentally inoculated rabbits and fowls death took place within 24 hours provided the animals were young. Adult birds and rabbits offered a considerable degree of resistance.

In natural cases the lesions appeared to be confined to the alimentary canal, which showed evidence of very severe inflammation.

The organism is said to occur "in thick curved blunted rods, or resembling cocci or small bacteria in the short thicker specimens, or in spiral filaments."

The organism is stainable by the simple anilin dyes, but not by Gram's method.

In broth it produces turbidity and a surface scum.

On agar there is a luxuriant yellowish-white growth.

In stab gelatin there is liquefaction and gas formation. On potato a yellowish brown growth develops.

In eggs inoculated according to Huppe's method the white is converted into a turbid yellow liquid and the yolk becomes quite black.

Indol was developed in the cultures.

- (33) HOLMES (J. D. E.). **A Note on the Effect of Heat on the Rinderpest Immune Bodies.**—*Bull. No. 43. Agricultural Research Institute. Pusa*, 10 pp. 1914. Calcutta: Superintendent Government Printing. India.

The experiments recorded in this paper were carried out with the double object of ascertaining: (1) whether exposure to a moderately high temperature for several days, or to a high temperature for a short time had any detrimental effect on the serum; (2) the effects of sterilisation on the potency of the serum.

Certain tests carried out by LINGARD appeared to show that the subjection of the serum to moderate temperatures for considerable periods (some months) produced deterioration.

Three sets of experiments were carried out. In the first the serum was exposed to a temperature of 45° C. for 7 days before use. This degree of heating was found to be without effect upon the protective power of the serum.

In the other two series of experiments the serum was heated to 55° and 65° C. respectively for one hour, and in both instances the original potency of the serum was retained.

The conclusions are drawn that anti-rinderpest serum can be sterilised with safety, and that the action of the serum is not dependent upon a complement present in itself.

- (34) M'LEOD (J. W.) & SOGA (A. R. B.). **A Simplified Method for the Cultivation, in Fluid Media containing Coagulable Albumin, of Bacteria requiring Anaerobic Conditions, notably the Pathogenic Spirochaetes.**—*Jl. Path. & Bact.* 1914. Oct. Vol. 19. No. 2. pp. 210-213. With 1 text fig.

A tube is fitted with an india rubber bung carrying a piece of glass tubing which does not quite reach the lower surface of the bung. Above the bung the tube is drawn out and bent over at an acute angle. The tube is filled to half or two-thirds of its depth with broth, which is then sterilised in the autoclave. When the liquid is cool sterile rabbit kidney is introduced. The tube is inoculated by dropping into it a bead through which is passed a piece of cotton wool soaked in the seed material. This ensures the seed material shall be near the piece of kidney where conditions are most suitable for growth. Finally ascitic fluid is run in until the level of the liquid is within half the length of the bung from the top of the tube. The bung is then pushed in, the liquid rises up in the tube and when it reaches the end of the drawn out tube this is sealed off.

The method is not applicable to gas producing bacteria.

The authors have been able to cultivate three strains of spirochaetes received from NOGUCHI by this method, 50 to 60 per cent. of the cultures being successful.

- (35) CHATTERJEE (G. C.). **A Culturable Free Living Flagellate and the Determination of the Lethal Value of Certain Chemicals thereon.**—*Indian Jl. Med. Research.* 1914. Oct. Vol. 2. No. 2. pp. 594–603. With 1 coloured plate.

The flagellate, which discovered in a sample of tank water was found to grow very well in broth or peptone water.

The organism possessed two flagella, a rudimentary undulating membrane, and basal granules. The morphology varied somewhat according to the medium used for cultivation. The large forms which developed in broth measured 10 to 20 microns in length by four in width, and the flagella were of unequal length measuring 10 and 5 microns.

In salt solution shrunken elongated forms were found. In tap water large spherical forms developed. The identity of these different types was proved by cultivation experiments.

Multiplication occurred at 18° and 20° C., but it was more vigorous at body temperature. At 40° C. multiplication ceased and at 45° C. the parasite died in five minutes.

Tabular statements are given of the effects of a number of chemical substances used on the lines of the Rideal Walker tests.

REPORTS.

- (36) GOLD COAST. **Report on the Veterinary Department for 1913,** by W. P. B. BEAL. 1914. 24 pp. f'cap. Accra: Printed at the Government Press.

Anthrax.—One suspected case occurred in a horse, the animal being destroyed.

Contagious Bovine Pleuro-pneumonia.—One outbreak occurred at Colebro in N.W. Ashanti and one at Nantong in the Northern Territories.

Trypanosomiasis.—Treatment of horses suffering from this disease has been carried out on the same lines as before (see this *Bulletin*, Vol. 1, p. 188), but the orpiment was given *in bolus* instead of in drenches.

The atoxyl injections were repeated on the 6th and 7th days because there is a rise of temperature observed from the 5th to the 8th days.

There is evidence to show that the cures effected are not permanent, the apparently cured animals harbouring trypanosomes in the blood.

Tabanidae.—The following species have been caught: *T. besti* Surc., *T. kingsleyi* Ric., and *T. marmoratus* Surc.

The commonest trematode worm is *Gastrodiscus aegyptiacus*, and it is estimated that 75 per cent. of the horses are hosts of this parasite. It is easily expelled by anthelmintics and aloes.

(37) **BRITISH EAST AFRICA. Annual Report 1912-1913. Dept. of Agriculture.** [Veterinary Department by R. J. STORDY. pp. 23-41.]

East Coast Fever.—The inoculation with spleen or gland pulp according to Theiler's method is considered to be inapplicable owing to the high death-rate caused, and it is stated that a method of vaccinating with infective spleen pulp, peptone, and blood from an immune animal is being elaborated at Kabete Laboratory. Investigations have been made into the "frequent dipping" method of dealing with the disease.

Rinderpest.—The mortality caused by this disease cannot be estimated, but it has occurred in all but a few districts.

It is reported the Masai have no desire to escape the disease and even introduce it, as they are willing to pay the toll in young stock in order to have immune survivors.

Attention is drawn to varying virulence of the strains and the varying degree of its rapidity of spread.

Pleuro-pneumonia.—No outbreaks of this disease have been recorded.

Quarter Evil.—Outbreaks have occurred, but a vaccine has been prepared to combat this disease.

Anaplasmosis.—This disease has been slightly more prevalent than during the preceding year.

Trypanosomiasis of Cattle.—No case has come under notice except a few among cattle imported from Uganda for experiment.

Ephemeral Fever or Three Days' Sickness.—Several outbreaks have been recorded from the neighbourhood of Nairobi. This disease is due to a specific organism which is present in the blood of sick animals, and the disease can be transmitted by the inoculation of such blood.

Animals of all ages and breeds are susceptible, but young animals appear to be more resistant than adults, and in animals in fat condition the disease runs a more rapid course than in those in poor condition.

The period of incubation after blood inoculation is two or three days, and the period of immunity resulting from infection is six weeks. The blood of a recovered animal is non-infective.

The symptoms are:—Elevation of temperature with the usual external evidences of fever, watery discharge from the eyes and nose, painful lameness in one or more limbs, which may rapidly pass from one limb to another, stiffness of the whole body and especially of the neck, the latter being associated with difficulty in swallowing, constipation with faeces covered with mucus. Within 48 hours the symptoms begin to abate and by the third day the animal is generally convalescent.

The only constant lesion is enlargement of the lymphatic glands, particularly the prepectoral group.

The disease is seldom or never fatal, but a fatal result may follow an attempt to drench an animal that cannot swallow.

Although it has been suggested that the disease is insect transmitted, there is no evidence to that effect.

The number of cattle affected ranges from 12 to 33 per cent. of the total number in the herd.

Horse Sickness has been very prevalent.

A disease closely resembling horse sickness, but which appears to be non-transmissible by blood inoculation has been observed.

Epizootic Lymphangitis is widespread in the country, and possibly a quarantine station will have to be established at Rumuruti for importations from the North. "606" was found to be useful in the early stages of the disease.

Ulcerative Lymphangitis has been reported mainly from the Uasin Gishu Plateau.

Experiments are in hand regarding this disease.

Strongylosis in Sheep is very widespread and is responsible for great losses. Drenching with lysol has had the most beneficial results.

Warty Papillomata of the face, lips, and feet of Sheep.—This is a common condition on the Uasin Gishu Plateau.

In the early stages there are dry warty tumours on the lips. These increase in size and become horny. If peeled off a tender raw surface is left. The ears and coronets may also be affected.

In pure and half-bred imported sheep the course of the disease is generally acute and the mortality higher than in indigenous hairy sheep. Goats are not affected, and the disease appears to be contagious.

Swine Fever.—Three outbreaks have occurred, with a mortality of 100 per cent.

This is just a possibility that a protective serum will be obtainable, as one pig at the laboratory appears to be acquiring a resistance through the injection of virus attenuated by heat.

Tick fever in the dog has been as prevalent as usual, and trypanblue has given good results.

A form of distemper, which appears to be somewhat different from the English type of the disease has been prevalent.

Rabies.—A number of cases occurred in dogs as a result of the bites of jackals, and though a number of natives were bitten no cases of hydrophobia have resulted. It is said that the form of rabies occurring in British East Africa resembles that described as occurring in Senegal, which chiefly affects dogs.

(38) **EGYPT. Annual Report of the Veterinary Service for 1913. Ministry of Agriculture. 1915. 27 pp. Cairo: Government Press.**

Cattle Plague.—This disease has been responsible for 2,314 deaths, including 490 following double inoculation in outbreaks. The death-rate from natural infection was about 0.14 per cent. The number of cattle inoculated was 178,495. Of these, 569 died of rinderpest and 1,452 of other diseases, including 908 of Texas fever. In areas where double inoculation was systematically carried out, no subsequent cases occurred. The percentage of deaths following the inoculation was 1.12.

Rabies was observed in 74 cases among animals, which included two cats, one donkey, and one wolf, the remaining cases being in dogs.

Sixty-six cases of glanders were detected, and 20 of epizootic lymphangitis.

Five hundred and forty-four cases of anthrax were reported, of which 527 were in sheep.

Sheep-pox cases numbered 132.

Three hundred and forty cases of foot-and-mouth disease occurred.

Ten cases of trypanosomiasis were detected. One of these was in an ox, in which species the disease has not previously been detected in Egypt. The parasite appeared to be identical with *T. theileri*.

Filariasis was detected in two camels.

Piroplasmosis was reported in 946 cases, mainly due to double inoculation.

No cases of stiff sickness were reported.

Eighty-nine cases of contagious bovine pleuro-pneumonia were reported.

Three horses, which had been treated for trypanosomiasis two years previously with apparently complete success, were tested by the inoculation of their blood into dogs. In each case the dogs failed to become infected and were subsequently proved to be susceptible.

(39) SINCLAIR (J. M.). Report of Enquiry into the Health of Cattle in Texas [MS.]. Dated Dec. 31st. 1914.

Redwater.—This disease is confined to the Southern half of Texas, and is slowly being stamped out. Young animals appear to be more seriously affected than is the case in Rhodesia.

The effects following inoculation of pure bred stock are practically identical with those observed in Rhodesia except that the mortality due to inoculation is put at 3 per cent., and on subsequent exposure to infection at 5 per cent., but the latter figure is said to be sometimes much higher.

“ In Rhodesia the heavy mortality has been attributed to anaplasmosis or gall sickness, which, according to Theiler and other observers, is a disease entirely different from redwater. The results of Bevan's work during the last two years have caused him to doubt the separate identity of the two diseases—viz., redwater and gall sickness—and in this he is supported by the fact that conditions exactly the same, as far as I can judge, are regarded by Francis and other American observers as part and parcel of redwater.”

Nodular Vaginitis.—The nodular condition of the mucous membrane and the muco-purulent discharge may make their appearance when the animal is a few weeks old and persist for three or four years. Sinclair thinks the weight of evidence is with those who attribute abortion, retention of the placenta, and diseased conditions of the uterus to oviducts and ovaries which cause sterility. The condition is widely spread in the United States, and though no Texan stockowner was met who knew of the disease, its discovery in a large proportion of animals at the Meat Inspection Department at Fort Worth proves its existence.

Infectious Abortion is very widespread in Texas, especially in dairy herds.

Anthrax and black quarter are responsible for great losses. The Pasteur method of vaccinating with vaccine prepared by commercial firms has yielded very unsatisfactory results.

Psoroptic mange occurs to a considerable extent.

Foot-and-mouth disease was not existent in Texas at the time of writing, but it had broken out in 13 States in the United States a month or two previously.

Contagious pleuro-pneumonia does not occur.

Tuberculosis.—This is very prevalent among dairy cattle, and has been frequently demonstrated among the range cattle.

The report concludes with suggestions based upon the information obtained as to the steps that should be taken if animals are imported into Rhodesia from Texas.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 2, No. 4, pp. 203-204.]

Anaplasmosis.

- (40) SANGIORGI (G.). Reperto di "Corpi Anaplasmasimili" nel Sangue dell'Uomo e degli Animali. [The Discovery of Anaplasma-like Bodies in the Blood of Man and Animals.]—*Pathologica*. 1915. Jan. Vol. 7. No. 149, pp. 27-29.

Leishmaniasis.

- (41) CHRISTOPHERSON (J. B.). On a Case of Naso-oral Leishmaniasis (corresponding to the Description of Espundia); and on a Case of Oriental Sore, both originating in the Anglo-Egyptian Sudan.—*Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3, pp. 485-494. With 2 plates.
- (42) MACKIE (F. P.). The Progress of Kala-Azar in a Localised Community.—*Indian Jl. Med. Research*. 1914. Oct. Vol. 2. No. 2, pp. 505-509.
- (43) MACKIE (F. P.). Note on Some Bodies of Unknown Nature found in the Faeces of Kala-Azar Patients.—*Indian Jl. Med. Research*. 1914. Oct. Vol. 2. No. 2, pp. 510-515. With 1 coloured plate comprising 3 figs. and 1 map.

Tick Paralysis.

- (44) TODD (J. L.). Tick Paralysis.—*Jl. of Parasitology*. 1914. Dec. Vol. 1. No. 2, pp. 55-64.

Biting Flies and Ticks.

- (45) CORNWALL (J. W.) & PATTON (W. S.). Some Observations on the Salivary Secretion of the Commoner Blood-sucking Insects and Ticks.—*Indian Jl. Med. Research*. 1914. Oct. Vol. 2. No. 2, pp. 569-593. With 2 charts.
- (46) NUTTALL (G. H. F.). Tick Abnormalities.—*Parasitology*. 1914. Oct. Vol. 7. No. 3, pp. 250-257. With 11 text figs.
- (47) NUTTALL (G. H. F.). Penetration of Ixodes beneath the Skin.—*Parasitology*. 1914. Oct. Vol. 7. No. 3, pp. 258-259.
- (48) SCHWETZ (J.). Quelques Observations Préliminaires sur la Morphologie et la Biologie de la Larve, de la Nymphe, et de l'Image de l'*Auchmeromyia luteola* Fabr.—[Preliminary Observations regarding the Morphology and Biology of the Larva, Nymph and Imago of *Auchmeromyia luteola*].—*Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3, pp. 497-507.

Helminths.

- (49) CORT (W. W.). Larval Trematodes from North American Fresh-water Snails.—*Jl. of Parasit.* 1914. Dec. Vol. 1. No. 2, pp. 65-84. With 15 text figs.
- (50) SEURAT (L. G.). Sur un Nouveau Gongylonème, Parasite de la Gerbille. [A New Gongyloneme Parasite of the Gerbil].—*C. R. Soc. Biol.* 1914. Dec. 11. Vol. 77. No. 31, pp. 521-524. With 4 text-figs.

- (51) SEURAT (L. G.). Sur une Filaire Péritonéale du Macroscélide. [A New Peritoneal Filaria of the Macroscelide.]—*C. R. Soc. Biol.* 1914. Dec. 11. Vol. 77. No. 31, pp. 524–527. With 3 text-figs.
- (52) SEURAT (L. G.). Sur un Nouvel *Ophiostomum* Parasite du Gundi. [A new *Ophiostomum* parasitic in the Gundi.]—*C. R. Soc. Biol.* 1915. Feb. 5. Vol. 78. No. 2, pp. 20–22. With 4 text-figs.

Protozoa.

- (53) CRAIG (C. F.). New Varieties and Species of Malaria Plasmodia.—*Jl. of Parasit.* 1914. Dec. Vol. 1. No. 2, pp. 85–94.
- (54) FANTHAM (H. B.) & PORTER (A.). The Morphology, Biology, and Economic Importance of *Nosema bombi*, n. sp., Parasitic in various Humble Bees (*Bombus* spp.).—*Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3, pp. 623–638. With 1 plate.
- (55) LAVERAN (A.) & FRANCHINI (G.). Infezione dei Mammiferi per Mezzo di Flagellati di Vertebrati. [The Infection of Mammals by Means of Flagellates of Vertebrates (? Invertebrates).] *Pathologica.* 1915. Jan. Vol. 7. No. 149, pp. 29–31.
- (56) PORTER (A.). The Morphology and Biology of *Herpetomonas patellae*, n. sp., Parasitic in the Limpet, *Patella vulgata*, together with Remarks on the Pathogenic Significance of Certain Flagellates found in Invertebrates.—*Parasitology.* 1914. Oct. Vol. 7. No. 3, pp. 322–329. With 17 text-figs.

Unclassed.

- (57) SEIDELIN (H.). Notes on the Pathology of Yellow Fever in Guinea-pigs.—*Jl. Path. & Bact.* 1915. Jan. Vol. 19. No. 3, pp. 317–320. With 2 plates comprising 8 figs.

For CONTENTS. see pages 3 & 4 of Cover.

pp. 41-79.]

[June 30, 1915.

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Vol. 3.

1915.

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VOL. 3.]

1915.

[No. 2.

BABESIASIS (PIROPLASMOSIS).

- (58) WENYON (C. M.). **Piroplasmosis of Rhodesian Sheep, as observed, by Bevan.**—*Jl. Comp. Path. & Therapeutics*. 1915. Mar. Vol. 28. No. 1. pp. 60-61.

BEVAN has forwarded to the Wellcome Bureau of Scientific Research a number of blood films from a Rhodesian sheep which was suffering from both anaplasmosis and piroplasmosis.

That the parasites present were piroplasms and not organisms of the Theileria type was shown by the fact that no bodies resembling Koch's bodies were found in any of the internal organs. The parasites were, however, very variable in shape and some of them were very small. As none but local sheep were available for inoculation it is possible that the experimental inoculations carried out may not succeed, owing to the animals used having acquired some degree of immunity.

TRYPANOSOMIASIS.

- (59) LANFRANCHI (A.). **L'Oftalmo e l'Intrapalpebro-reazione nella Diagnosi e nella Differenziazione di Alcune Tripanosomiasi. Nota Preventiva.** [The Ophthalmic and Intrapalpebral Reactions in the Diagnosis and Differential Diagnosis of the Trypanosomiasis. Preliminary Note.]—*Il Moderno Zooiatro*. Parte Scientifica. 1915. Jan. 31. Vol. 36. No. 1. pp. 1-3. With 2 text-figs. and *Bull. Soc. Path. Exot.* 1915. Mar. Vol. 8. No. 3. pp. 112-115.

In this paper the author briefly records some observations regarding the diagnosis of trypanosomiasis by means of the ophthalmic and the intrapalpebral tests, using extracts of trypanosomes derived from rats. The trypanosomes used in the experiments were the trypanosome of surra and *T. brucei*. The extracts were made with glycerin, alcohol, ether, chloroform, and distilled water, following LEVADITI'S technique.

The conclusions are as follows :—

It was possible with a glycerin or an alcoholic extract of the infecting trypanosome not only to arrive at a diagnosis of surra in the dog, but to distinguish the infection from nagana.

In the horse it was possible to obtain similar results with these extracts, both by the ophthalmic and the intrapalpebral methods.

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The author intends to examine the question as to whether during afebrile periods a diagnostic elevation of temperature can be obtained by the intrapalpebral test.

- (60) WEBB (E. Clive). **Trypanosomiasis of Donkeys and Mules in the Anglo-Egyptian Sudan.**—*Jl. Comp. Path. & Therapeutics*. 1915. Mar. Vol. 28. No. 1. pp. 1-20.

The common trypanosome of the mule and the donkey in the Sudan is a polymorphic one, and the author thinks that it is identical with the polymorphic *T. brucei*. Brief details are given of a number of experimental inoculations carried out both with mule and donkey trypanosomes upon a variety of species of animals.

The paper also includes an account of the treatment with atoxyl and arsenic adopted in the case of a number of diseased mules and donkeys. The general lines followed were those laid down by HOLMES for the treatment of surra.

The total number of animals submitted to treatment was 22. Of these 12 died and 10 recovered.

The results obtained are not so favourable as those obtained by HOLMES, but provided the cures are permanent they are not unsatisfactory. It is pointed out that the great majority of animals were in very poor condition when the treatment was started and some of them were actually in extremis.

In treating the animals the dosage was severe, the treatment being pushed to a dangerous extent; one of the reasons for this being that any treatment which is to be economically practicable must be of short duration. Owing to a shortage of atoxyl, treatment with arsenic was adopted as far as possible, and in five instances death was actually due to or hastened by arsenical poisoning.

- (61) AUBERT (P.) & MICHELI (M.). **Essais de traitement des infections expérimentales à *Trypanosoma gambiense* et *dimorphon* avec des "Suspensions huileuses d'Arserie et d'Antimoine" (Métoléine).** **Note préliminaire.** [Experiments regarding the Treatment of Animals infected with *T. gambiense* and *T. dimorphon* by Means of Arsenic and Antimony suspended in Oil (Metoleine). Preliminary Note.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 28-30.

The name Metoleine has been given by DEGUY and LESURE to suspensions in oil of finely divided metals or metalloids. The arsenic metoleine contains 8 per cent. of arsenic and the antimony metoleine 20 per cent. of antimony. The oily excipient contains 11.75 per cent. of anhydrous lanoline and 88.25 per cent. of vaseline oil.

The authors have carried out a small number of experiments with guinea-pigs experimentally infected with *T. gambiense* and *T. dimorphon*.

The drugs were administered in doses ranging from $\frac{1}{10}$ - $\frac{3}{10}$ cc. by intramuscular injection, and no evidence of reaction was observed at the seat of injection. Both the suspensions appeared to exercise a distinct trypanocidal effect.

The metals are absorbed very slowly and also very slowly eliminated.

- (62) LAVERAN (A.). **Le dérivé O₁ du Diaminoarsénobenzène dans les trypanosomiasés du chien et du cobaye.** [The O₁ Derivative of Diaminoarsenobenzene in the Treatment of Trypanosomiasis of the Dog and the Guinea-pig.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 31–32.

Five dogs infected with *T. gambiense*, *T. congolense*, and *T. soudanense* were treated by intravenous injections of O₁ in doses of 2 to 3 cg. per kilogramme. Of the three dogs infected with *T. congolense* two appeared to have made a complete recovery after 6 or 8 injections. In the two dogs inoculated with *T. gambiense* and *T. soudanense* only a temporary improvement was noted, a fatal termination occurring in both cases.

Possibly the results were not as good as they might have been owing to the fact that only 2 cg. per kilogramme were given at first, whereas 3 cg. is borne quite well by the dog.

Experiments with guinea-pigs failed owing to the production of very severe lesions at the seat of injection when the drug was administered intramuscularly.

In one instance, however, a remarkable result was obtained. A guinea-pig inoculated with an atoxyl-resistant strain of *T. gambiense* was given an injection (method not stated) of 5 cg. of O₁. The trypanosomes disappeared from the circulation in 24 hours. Four further injections of 4 to 5 cg. were given and trypanosomes did not reappear in the blood until the 57th day after the first injection. The guinea-pig died five days later after giving birth to five dead young.

- (63) MESNIL (F.) & MOTAIS (F.). **Sur l'action trypanocide *in vivo* d'un dérivé (OK₁) du diaminoarsénobenzène.** [The Trypanocidal Action *in vivo* of OK₁ a Derivative of Arsenobenzene.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 32–34.

In this short paper the author publishes the incomplete results of some experiments which were interrupted in August 1914.

OK₁ is a yellowish powder which is very stable when exposed to the air, is easily soluble in water, and when in solution does not rapidly undergo any alteration. Subtoxic doses when injected subcutaneously are well borne.

By experiment it was found that the toxic dose for a mouse weighing 20 grammes was 0.60 cg. The therapeutic dose for a mouse of this size was therefore fixed at 0.3 cg. Three mice infected with nagana and six with *T. gambiense* were subjected to treatment, and recovery occurred in every instance. Exactly similar results were obtained with arsenophenylglycin administered in the same dose.

In every case trypanosomes were numerous in the blood when the treatment was resorted to, and disappeared from the blood within 36 hours. With arsenophenylglycin this disappearance occurred rather more rapidly.

As rats are, in the opinion of the authors, more difficult to cure than mice, two series of experiments were undertaken with this species. The trypanosome used was *T. gambiense*, and the strain used caused a fatal result in mice in 7 days.

The dose used was the same as for mice, i.e., 0.3 cg. per 20 grammes.

In the first series a few of the rats died of intoxication within a few days of the administration of the drug, but those that survived showed no relapse for a period of a month after.

In the second series some of the rats were treated with arsenophenylglycin, and save in one instance the results were exactly the same.

It is admitted that a month is not a sufficiently long period to allow of a definite opinion as to the permanency of the cure, but it is considered to be sufficiently long to permit the conclusion to be drawn that OK₁ is not inferior to arsenophenylglycin in its trypanocidal action. It is superior to that drug in its stability.

- (64) LAFONT (A.) & DUPONT (V.). **Action comparée, in vivo, chez le rat blanc, de l'atoxyl du salvarsan, du néosalvarsan, du galyl et du ludyl sur *T. gambiense* et *Tr. rhodesiense*.** [The Comparative Actions of Atoxyl, Salvarsan, Neosalvarsan, Galyl and Ludyl upon White Rats infected with *T. gambiense* and *T. rhodesiense*.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 37-46.

The conclusions based upon the experiments detailed in this paper may be summarised as follows:—

1. In doses of 0.15 cg. per kilogramme, salvarsan, neosalvarsan, and ludyl do not lead to any diminution in the number of parasites present in the blood, while, on the other hand, a single injection of the same dose of galyl causes a complete disappearance in from 4 to 8 days.

2. While the duration of life in rats infected with *T. gambiense* is on an average 12 days, ludyl and neosalvarsan in the dose mentioned do not cause any change in this period. In rats treated with salvarsan the average period is 18 days, and in those treated with galyl 22 days.

- (65) SEIDELIN (H.). **Experiments with Salvarsan-Copper in Trypanosomiasis.**—*Ann. Trop. Med. & Parasit.* 1915. Mar. Vol. 9. No. 1. pp. 197-200.

The author has carried out a small number of experiments with a salvarsan-copper compound named K₃ obtained from EHRLICH, using rats experimentally infected with a trypanosome of the *T. brucei* group, which had been maintained for some time in rats and guinea-pigs, and proved fatal to the latter species in eight to seventeen days after intraperitoneal inoculation.

It was found that a dose of 0.0064 g. failed to effect a permanent cure in rats weighing 60 grammes, and with this dose areas of necrosis at the seat of inoculation were produced in some cases and in others death resulted.

- (66) DUKE (H. L.). **The Wild Game and Human Trypanosomiasis; with some Remarks on the Nomenclature of Certain Pan-African Trypanosomes.**—*Jl. Trop. Med. & Hyg.* 1915. Jan. 15. Vol. 18. No. 2. pp. 13-16.

In this paper reference is first made to the trypanosomes occurring in man. The features of these parasites to which attention is drawn are the following: *T. gambiense* is insusceptible to the action of human serum, it causes a chronic disease in cattle, sheep and goats,

and runs a relatively chronic course in dogs and small laboratory animals. *T. rhodesiense* on the other hand is susceptible to the action of human serum, and produces a more acute infection both in man and in animals. Neither of the trypanosomes causes disease in wild animals.

Proof has been furnished of the part played by game as a reservoir for *T. gambiense* by the fact that two fly boys employed by CARPENTER have contracted the infection after a residence of 18 and 33 months on the lake shore, and this at an interval of five years after the removal of the inhabitants.

The facts with regard to the other trypanosome causing disease in man—*T. rhodesiense*—are different. There has never been anything like the loss of life caused by this organism that there has been by *T. gambiense*, and eminent English observers are of the opinion that the evidence indicates that *T. rhodesiense* and the polymorphic trypanosomes showing posterior nuclear forms occurring in game are identical.

In addition to these polymorphic trypanosomes there are two easily recognised types which have a very wide distribution. These are the *T. vivax*, and the *T. congolense-nanum* (*pecorum*) groups.

During their development in *Glossina* these three groups behave in different ways. In the *vivax* group only the proboscis of the fly is invaded; in the *congolense* group the gut and the proboscis are involved; and in the polymorphic group development takes place in the gut and the salivary glands.

The majority of mammalian trypanosomes occurring in Africa can be placed in one or other of these groups, and in the author's view difficulties arise when attempts are made to get further subdivisions, owing to the unnatural way in which the finer tests are carried out. Emphasis is laid upon the part played by the transmitting flies, and upon the inadvisability of founding any conclusions upon the study of strains that have been maintained exclusively by means of the syringe.

According to Miss ROBERTSON the morphological changes observed in the polymorphic strains indicate definite phases of development of the trypanosomes in the mammalian host. The short form is believed to be especially connected with the infection of the fly, because when the proportion of short forms is high a high percentage of positive flies fed upon such blood is obtained.

Another example of the confusion that has arisen owing to insufficient attention being paid to natural conditions is given in connection with *T. nanum* and *T. congolense* (*pecorum*). Originally the strains were distinguishable by their action on the dog and also by the different degree of pathogenicity possessed by them for domesticated ruminants. Upkeep of these strains in the laboratory has gradually eliminated these characteristics.

The suggestion is put forward that all these polymorphic trypanosomes, excluding *T. gambiense*, should be looked upon as one species having its anterior seat of development in the fly in the salivary glands, primarily a parasite of wild game, and too pathogenic for domesticated animals for these to be the principal hosts. *T. gambiense* is mainly distinguished from the other polymorphic strains by its unflinching pathogenicity for man.

With regard to the nomenclature of these parasites the author suggests that they should all be termed *T. brucei*, and he does not consider that *T. rhodesiense* should stand as a good species until it has been proved that the power of infecting man can be maintained through the fly, and that man can be infected from man.

(67) DELANOË (P.). Au sujet des trypanosomes du type *T. lewisi* Kent rencontrés chez des Muridés dans la région de Bouaké (Côte d'Ivoire). [The Occurrence of Trypanosomes of the *lewisi* Type in the Muridae encountered in the Bouaké District of the Ivory Coast.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 80-88. With three groups of text-figs.

In 7 out of 53 striped rats belonging to the varieties *Arvicanthis barbarus* and *Arvicanthis barbarus pulchellus* the author has discovered trypanosomes of the *lewisi* type. In five of these animals the parasites were numerous in the blood. Morphologically the trypanosome appears to resemble *T. lewisi* very closely. No lesions were found in the bodies of rats killed when parasites were present in the blood in large numbers.

Adult white rats appear to offer a very high degree of immunity to inoculation with this trypanosome, but it would seem that young white rats can be infected by intraperitoneal inoculation. Two out of three grey rats became infected.

A guinea-pig and some mice failed to become infected, but two young specimens of *Golunda campanae* Huet (a small rodent somewhat resembling the jerboa) became infected and recovered. Owing to the lack of details the author is unable to say whether this trypanosome is identical with that described by WENYON as occurring in the striped mouse in the Soudan.

Trypanosomes of the *lewisi* type were found in 9 out of 66 specimens of *Mus concha* Smith examined. To this parasite the author has given the name *T. eburneense*. As in the case of the previous trypanosomes, the infected animals were caught during both the dry and the rainy seasons. In eight instances the blood was swarming with trypanosomes.

Measurement of 36 parasites appeared to indicate that it is rather longer than *T. lewisi*, and the author believes that the trypanosome is pathogenic, as in two out of four cases rodents of the same species inoculated intraperitoneally died in 25 and 33 days respectively.

Golunda campanae, which has not been found to be naturally infected, is very susceptible to inoculation, while three striped rats failed to become infected. The white rats appear to be refractory, and in the guinea-pig intraperitoneal inoculation leads to a limited multiplication of the parasites in the peritoneal cavity only. *Xerus erythropus* is susceptible, but recovery confers immunity.

A third trypanosome, to which the author gives the name *T. guist'havi*, has been found in savannah rats. Sixteen were found to be infected out of 128 examined. In every instance the parasites were very scantily present in the blood.

The trypanosome ranges from 42 to 47 microns in length.

Young savannah rats, striped rats, *Golunda campanae*, and white rats all resist inoculation.

- (68) VIALATTE (C.). **Au sujet d'un trypanosome du chien observé dans le Sahara Oranais.** [A Trypanosome of the Dog discovered in the Oran District of the Sahara.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 70-72.

The animal in which the trypanosome was discovered showed a train of symptoms similar to those generally encountered in cases of trypanosomiasis, and in the later stages there was paralysis of the hind quarters. Examination of the blood on a number of occasions showed that the parasite was sometimes numerous present, sometimes in small numbers, and sometimes quite absent.

The trypanosome ranged from 17 to 24 microns in length and from 1.5 to 2 in width. The free portion of the flagellum measured from 3.5 to 5 microns. The posterior extremity of the body was always more or less obtuse, and granules were frequently present in the anterior half of the body.

Experiments are being carried out with the object of identifying the parasite if possible, but the author appears to incline to the view that the trypanosome closely resembles, at least from the morphological point of view, *T. soudanense* var. *berbera*.

- (69) SERGENT (Edm.), LHÉRITIER (A.) & LANDES (L.). **Absence d'immunité héréditaire à l'égard du *Trypanosoma soudanense* chez un chèvreau né d'une chèvre immunisée envers ce Trypanosome.** [Absence of Immunity against *T. soudanense* in a Kid born of a Goat immunised against this Trypanosome.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 73-74.

The authors give the details of an experiment the results of which confirm those obtained by LAVERAN regarding the non-transmission of immunity from parent to offspring.

- (70) TERRY (B. T.). **The Influence that Serum exerts upon Trypanosomes, with Special Reference to its Use for Experiments in vitro with Atoxyl and Paraminophenylarsenoxyl.**—*Jl. Experim. Med.* 1915. Mar. 1. Vol. 21. No. 3. pp. 250-257.

The bulk of this paper comprises the results of observations made regarding the effects produced upon trypanosomes suspended in salt solutions and sera.

A number of experiments were made in which trypanosomes were suspended in normal salt solution, Ringer's solution made up according to the formulae of MELTZER and of CARREL, and serum derived from different species of animals. In every instance the parasites retained their motility better in the serum than in the other liquids, in which the results were rather variable on different occasions.

Further comparisons were made in which the tubes were kept in an ice chest instead of at room temperature as in the first experiments, and from these it was seen that vitality was retained for a longer time in tubes kept at room temperature than in those kept in the ice chest.

Experiments also showed that not only did the trypanosomes retain their motility and their normal staining reactions better in serum, but also that they retained their pathogenic powers better in the same liquid.

Before the effects of drugs could be tested in vitro it was essential that evidence should be obtained as to whether the serum would produce any alteration in the drugs after the manner of the changes produced by blood. The experiments carried out with this object showed that serum did not exert any actions upon the drugs comparable to those exerted by blood.

The author's conclusions may be summarised as follows :—

Serum preserves the motility of the trypanosome of nagana better than salt solution, and it is preferable to use the serum undiluted. The filtration of the serum through a Berkefeld filter and the storing of it for months in an ice chest does not cause any change in it in this respect.

The vitality of the trypanosomes was preserved better at room temperature than at the temperature of an ice chest, and trypanosomes preserved in serum at room temperature for eight days were capable of infecting experimental animals. Serum does not convert atoxyl into a toxic substance when incubated with it, nor does it bind paraminophenylarsenoxyd.

(71) BROWN (Wade H.). Concerning Changes in the Biological Properties of *Trypanosoma lewisi* produced by Experimental Means, with Especial Reference to Virulence.—*Jl. Experim. Med.* 1915. Apr. Vol. 21. No. 4, pp. 345–364.

The investigations detailed in this paper were carried out in the course of an inquiry into the possible causes of exalted virulence of *T. lewisi* for the rat, regarding which the author published a paper in 1914 (see this *Bulletin* 1914. Sept. Vol. 2. No. 3, p. 130).

In the instance of exalted virulence recorded in the above paper the indications were that either the method of passage adopted or the character of the rats used, or both of these factors, played some part in the causation of the change.

Four groups of experiments were carried out with the object of ascertaining whether these factors had any determining influence on the point, and two strains of the trypanosome, viz., the so-called pathogenic strain, and a recently isolated strain were used in each case.

In the first series of experiments the animals used were for the most part large, and the inoculations were the ordinary stock transfers. The rate of passage in this series was irregular and slow, and the inoculations were intraperitoneal, two drops of infective blood mixed with 0.5 cc. of salt solution being injected.

In the second series the method of inoculation was the same, but the inoculations were made as nearly as possible at the height of the multiplication of the parasites. Large rats were again used.

In the third series the conditions of the second series were repeated, with the exception that small rats were used in the place of large ones.

In the fourth series, which was a control series, the rats were inoculated in pairs, and at the height of the multiplication of the trypanosomes one of each pair was killed and its blood was used for the inoculation of a fresh pair.

The whole of the results obtained are set out in the form of tables, and the changes produced are grouped under various headings.

In connection with the cycle of infection it was found that when successive inoculations were made at short intervals the tendency was for the period of incubation to become shorter. Special attention is directed to the distinction that must be drawn between true and false incubation, the latter being the appearance of trypanosomes in the blood within a few hours after inoculation when large numbers of trypanosomes are used for infection. It was further found that rapid passage tended to shorten the period between the first appearance of the parasites in the blood and their maximum degree of multiplication. In some instances also it was observed that the duration of the infection tended to become shorter when rapid passage was practised.

The degree of virulence of the trypanosomes in the various groups as judged by the severity of symptoms produced and the number of deaths occurring serially and not in individuals appeared to show that there was a cycle of change. A similar result was obtained with the rats inoculated with blood taken at different stages of infection. This was particularly the case with the pathogenic strain.

The changes in morphology have been described in the previous paper, but it is here pointed out that alterations in morphology were mainly encountered in infections of considerable severity.

In addition to the foregoing experiments a further investigation was started in which the passages were effected when rats appeared to be on the point of recovery. The series could not be completed owing to the failure of the infections after a few generations, but certain results suggested that in such cases the infections might fail owing to the transference of a large quantity of immune bodies and a small number of trypanosomes.

The results obtained are discussed at some length and the following summary is drawn up:—

“ 1. Different strains of *Trypanosoma lewisi* represent different states of biological balance, especially between the powers of propagation and resistance to destruction.

“ 2. The biological status of a given strain of *Trypanosoma lewisi* is subject to cyclic variations as the result of immunological reactions in the blood of the host.

“ 3. The factors limiting reproduction and causing destruction of *Trypanosoma lewisi* in the blood are appreciably independent of each other. It is possible, therefore, to influence these processes separately and even in opposite directions.

“ 4. The virulence of *Trypanosoma lewisi*, manifested in its highest form, is dependent upon some degree of reproductive fastness, strong antigenic action, and susceptibility to destruction, varying degrees in the development of these properties producing corresponding variations in the degree of virulence.

“ 5. By a properly regulated system of passage the properties of *Trypanosoma lewisi* that determine its infection cycle and its virulence may be eventually so altered as to change completely both the nature and course of the infection. Such a system of passage must be adapted to the particular strain of *Trypanosoma lewisi* used.

“ 6. Immunological reactions exercise a dominant influence in determining the ultimate biological variations of *Trypanosoma lewisi*.”

(72) CARINI (A.) & MACIEL (J.). Sur un hémogregarine et un trypanosome d'un muridé (*Akodon fuliginosus*). [A Haemogregarine and a Trypanosome of *Akodon fuliginosus*.]—*Bull. Soc. Path. Exot* 1915. Apr. 15. Vol. 8. No. 4. pp. 165–169. With 2 text-figs.

(*Leuco-*) *Haemogregarina akodoni*.—The rats in which this parasite

was found showed no evidence of ill health even when considerable numbers of them were present in the blood. The parasites were oval in shape measuring 10 by 3·5 microns. The majority of the organisms seen were within large mononuclear leucocytes applied closely to the side of the nucleus. They possessed a hyalin cytoplasm and an oval granular nucleus. All the parasites appeared to be at the same stage of development and in none of them could a micronucleus be detected. Free forms in fresh preparations appeared to execute slow vermicular movements.

Trypanosoma akodoni.—In addition to the haemogregarines trypanosomes were also found in the blood of some of the rats examined. They were not numerous, but they could be found in every preparation made.

In the living state they were very actively motile. In stained preparations it was seen that the blepharoplast, which was situated close to the posterior extremity, was large and oval in shape, and was placed transversely in the body. The nucleus was placed about the middle point of the body, and the undulating membrane was well developed and showed two or three folds. The parasite appeared to resemble *T. cruzi*. It apparently failed to infect guinea-pigs and kittens which were inoculated by the authors.

Some laboratory bred larvae of *Triatoma infestans* were fed with blood containing the trypanosome, but no flagellates could be found in their intestinal contents.

- (73) OUZILLEAU (F.). **Rapport d'ensemble sur la maladie du sommeil dans le Bas-M'Bomou (1912-1913).** [Report on Sleeping Sickness in Lower M'Bomou.]—*Bull. Soc. Path. Exot.* 1915. Mar. Vol. 8. No. 3. pp. 138-154 & Apr. Vol. 8. No. 4. pp. 178-198.

This report contains a few lines regarding the trypanosomes encountered in animals in the district (pp. 197-198).

There are only two herds of cattle in the district, each of which numbers about 30 animals, and there are very few horses and donkeys. All the animals come from the Anglo-Egyptian Soudan.

No cases of trypanosomiasis in the horse have been encountered by the author. *Trypanosoma pecaui* has been seen in cattle, and on one occasion an outbreak caused by this parasite resulted in the death of ten out of thirty animals. A number of the cattle harboured the parasite without showing any clinical symptoms.

The same trypanosome was discovered at Bangassou in some donkeys which had been imported from Bahr-el-Ghazal.

- (74) MINCHIN (E. A.) & THOMSON (J. D.). **The Rat Trypanosome, *Trypanosoma lewisi*, in its Relation to the Rat Flea, *Ceratophyllus fasciatus*.**—*Quart. Jl. Microscop. Sci.* 1915. Jan. Vol. 60. No. 4. pp. 463-602. With 20 plates and 24 text-figs.

This monograph is divided into the following three parts:—

I. Notes on the flea, anatomy, methods of dissection, parasites of the flea, histological structure of the stomach, and technique.

II. Development of *T. lewisi* in the flea, (a) the stomach phase, (b) migration to the rectum, (c) rectal phase.

III. Experimental study of the problems of transmission and development.

In the first section full details of the methods adopted for the dissection of the fleas and of the anatomical structure of the organs are given.

Special attention is drawn to the fact that the authors' fleas were free during the whole of their experiments from flagellate parasites other than that with which they were working, and a summary of the evidence establishing this point is given.

The authors deal at considerable length with the technique adopted in the preparation of permanent specimens, both smears and sections.

In the second portion of the paper the development of *T. lewisi* in the rat flea is dealt with, and the following is a condensed account of the cycle.

Fleas which have been fed upon infected rats are not again infective for susceptible rats until a period of six days has elapsed, as the stumpy form of trypanosome which represents the final stage of development in the flea does not make its appearance in the rectum until the fifth day after the infecting meal.

Except for the occurrence of small crithidial forms in the Malpighian tubes the entire cycle of development is carried through in the alimentary canal. There is no invasion of the salivary glands.

The cycle of development can be divided into two more or less sharply defined phases, viz., a stomach and rectal phase.

The stomach phase is generally short, amounting only to 24-48 hours, but occasionally longer. During this phase the trypanosomes penetrate the epithelial cells of the stomach lining and undergo a process of multiple division.

In the intestine the trypanosomes do not come to rest, but merely pass through on their way to the rectum.

The rectal phase consists of small individuals which are crithidial in structure, and are attached by the end of the flagellum to the wall of the gut. In this position repeated binary fission occurs. This phase appears to continue as long as the flea remains alive. By modification the crithidial forms give rise to trypanosome forms by which the infection of the rat is brought about.

It is only about 25 per cent. of fleas that show these phases of development of the trypanosomes, in the remainder the trypanosomes ingested appear to die out, and consequently it is necessary to recognise those forms which represent degenerative changes. A great deal of information upon this point was gained by the authors through the examination of fleas at given intervals after feeding.

In the phases of normal development of the trypanosomes in the stomach the following stages in the process of multiplication can be established from the examination of smears and sections and of living preparations :—

1. Trypanosomes of ordinary appearance which seem to have recently penetrated into the epithelial cells.
2. Flat-end pear-shaped forms which are produced by a doubling of the body upon itself.
3. Rounded or oval forms which are produced from the pear-shaped forms by a further rolling or doubling up of the body. There are

apparently no leishmania-like forms without any flagellum. In these rounded forms process of multiplication can be seen. The division of the various structures goes on much as in ordinary trypanosomes. The flagellum does not split, but the daughter parasites are provided with new flagella which grow out from the daughter kineto-nuclei.

4. The final stage of intracellular multiplication is represented by the "sphere" stage. In this stage the parasites form large rounded masses in the epithelial cells. The invasion of any cell may be single or multiple, and the parasites are in a state of constant movement within the host cell. Some of these spheres show a "tail" composed of flagella and others are "tailless." In the latter the flagella are wrapped round the body. Finally the mass separates into a number of individuals which are set free by the rupture of the cell containing them. The number of individuals produced varies, but in many instances eight were observed.

The parasites produced in this way are crithidiomorphic, the nuclei being more or less closely placed to each other, and they are very long.

It cannot be stated how long this process of multiplication requires for its completion, nor can it be stated how many times it may be repeated.

The crithidiomorphic parasites pass straight through the intestine, and by the time that they reach the rectum the posterior extremity has generally become club-shaped.

In the rectal phase the parasite loses its very marked activity and becomes sluggish. It also shows a great tendency to adhere to debris, cells, and even to the cover-glass by means of its flagellum. The body becomes shortened and changes its shape owing to a concentration of the cytoplasm towards the posterior extremity of the body. The flagellum also becomes shortened. The kineto-nucleus takes up a position beside or in front of the tropho-nucleus, and then the parasites multiply by division. The order given does not of necessity indicate their chronological succession, but it is established that no multiple division occurs in the rectum, and also that there is no intracellular stage.

In the fully established rectal phase the parasites are all small crithidial forms, many of which are attached to the epithelial cells by their flagella. This phase is rarely established less than 36 hours after the infective feed. Multiplication of these forms in the rectum probably continues as long as the flea lives, but a proportion of the parasites become developed into stumpy trypaniform individuals which represent the final propagative phase, and at this stage the development in the rat comes to a stop.

Degenerative changes. Degenerating trypanosomes are most abundantly present in fleas examined during the first 24 hours after feeding, and they have generally quite disappeared within 36 hours, but they may sometimes be found later. The parasites either begin to degenerate immediately after they are taken up by the flea, or they may develop to a certain extent and then undergo degenerative changes. It is organisms that have proceeded to a certain stage of development before undergoing degeneration that account for the late degenerative changes observed.

The principal feature which marks degeneration is a progressive diminution in size, the shrinkage commencing at the flagellar end and

extending backwards. Degenerating forms show a great tendency to form clumps, but these clumps are distinguishable from the true agglomerations in that the parasites attach themselves to each other by the flagellar ends. In the final stage the parasites are very small, and they simply represent the hinder ends of the original trypanosomes. Among the degenerative forms in the rectum recurved forms similar to those normally occurring in the stomach are sometimes found.

The authors have never been able to find any evidence that there is a sexual stage in the development of *T. lewisi*.

In Part III. of the paper are discussed the experimental studies of the problems of transmission and development.

After dealing with the technique employed in the care and handling of the rats and fleas, the authors proceed to a discussion of the general problems.

It is held by the authors that the following facts have been established by experiment :—

Trypanosoma lewisi is transmitted from rat to rat by the rat-flea, *Ceratophyllus fasciatus*, and the transmission takes place by the cyclical method only. In a rat infected through the agency of fleas the trypanosomes appear in the blood on the fifth to the seventh day after infection, and multiplication of the parasite in the blood of the rat comes to an end 11 to 13 days after infection. In the flea the parasite requires a period of not less than five days for the completion of its cycle, and fleas are never infective until that cycle is completed. The infection of the rat is brought about through the medium of the small trypanosome-form which is the final stage of development in the flea and which takes place first in the rectum but may subsequently occur in the stomach also. The whole of the cycle of development goes on in the alimentary tract, and no other part of the flea is invaded by the trypanosome in any stage of its development. Once a flea has become infective it remains so for a long time. The rat becomes infected through ingesting either the moist faeces of infective fleas or the fleas themselves, and the authors' experiments indicate that the flea cannot infect rats through the medium of the proboscis. No evidence was obtained that the trypanosome is passed from flea to flea in an hereditary manner. Only a small proportion of the fleas which have access to infection become infective.

The starvation of fleas during the incubative period does not hinder the cycle of development in the flea.

LEISHMANIASIS.

- (75) SERGENT (Edm.). **Infections expérimentales de la souris par des cultures de la *Leishmania tropica*.** [The Experimental Infection of Mice with Cultures of *Leishmania tropica*.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 22–25.

The author gives details of six experiments in which mice were inoculated either intravenously or intraperitoneally with cultures of *L. tropica* which he had isolated about a year previously from a case of oriental boil at Biskra. The mice were killed four months after inoculation. None showed any skin lesions, but in five of them there

was found to be a generalised infection, and the remaining one was healthy. The parasites were discoverable both by microscopic examination and by cultivation.

The results obtained by other observers are briefly summarised and the conclusion is drawn that up to the present there is so much divergence that no definite opinion regarding the identity of the various strains of *Leishmania* can be expressed.

- (76) LAVERAN (A.). **Les Leishmanioses chez les Animaux.** [Leishmaniasis in Animals.]—*Ann. Inst. Past.* 1915. Jan. Vol. 29. No. 1. pp. 1-21,* and Feb., No. 2. pp. 71-104. With 2 plates and 2 figs.

iii. Experimental infections produced in different species of animals by *Leishmania donovani*—

It can no longer be held that Mediterranean and Indian kala azar differ from each other in regard to their inoculability into experimental animals, and particularly the dog and the monkey. The fact remains, however, that while the disease occurs as an enzootic among dogs in countries where the Mediterranean disease exists, all efforts to discover centres of canine leishmaniasis in India have, up to the present, failed. It has been found possible to infect dogs and other animals with the Indian disease provided a sufficiently large dose of infective material be given, but the evidence appears to show that the parasite is incapable of developing in *Ctenocephalus felis*, the common dog flea in India.

The paper contains somewhat lengthy summaries of experiments carried out by different observers, including the author, with regard to the infection of dogs, monkeys, flying foxes, mice, and rats, and reference is made to the negative results following the inoculation of guinea-pigs, rabbits, cats, and other animals.

Summarising the results obtained, the author draws attention to the following facts. *L. donovani* and *L. infantum* are both inoculable for the dog, certain species of monkeys, the white mouse, and with less certainty the rat, but the dog is less susceptible to the Indian disease than to the Mediterranean, or to the true canine infection. In addition to the fact that natural infection in the dog has not been observed in India in areas where the disease is endemic in man, is the further fact that it has been found possible to set up lesions in *Macacus* monkeys with the Indian virus, while attempts to infect the same species with *L. infantum* have so far failed.

A point which suggests the identity of the two diseases, while not furnishing absolute evidence, is that a *Macacus cynomolgus* which had acquired immunity against the Mediterranean disease failed to become infected with the Indian strain, while a control monkey contracted an infection which rapidly proved fatal.

iv. Natural and Experimental infections produced in different species of animals by *L. tropica*—

A summary is given of the recorded cases of cutaneous leishmaniasis in the dog, from which it appears that the condition is not common.

* For abstracts of previous portions of this paper see this *Bulletin*. Vol. 3. No. 1, pp. 19-20.

Some of the facts seem to suggest that one or more species of parasite different from *L. tropica* may be responsible for such lesions.

Experiments are cited to show that the dog, cat, monkeys of various species, mice, rat, guinea-pig, dormouse and merion can be successfully infected with *L. tropica*.

Among the animals in which no successes have been obtained are, the donkey, horse, goat, sheep, rabbit, sparrow, pigeon, and certain lizards.

The general conclusions drawn may be summarised as follows:— The parasite responsible for the disease in dogs cannot be distinguished morphologically from *L. infantum*, and clinically the natural disease of the dog closely resembles the condition set up in that species by inoculation with *L. infantum*. And, while there are still some points that require elucidation, the probabilities appear to be in favour of the view that the two parasites are identical.

With regard to the identity of the Mediterranean and the Indian diseases, it cannot be objected that animals that are susceptible to the one are refractory to the other, but dogs are certainly less susceptible to the Indian than to the Mediterranean infection, and, while it has been found possible to produce cutaneous lesions in monkeys with *L. donovani*, all attempts to produce similar lesions with *L. infantum* have so far failed. The unique experiments in which a cynomolgus monkey which was immune to the Mediterranean disease failed to become infected when inoculated with the Indian virus furnished valuable evidence regarding the identity of the two conditions.

With regard to the production of cutaneous lesions in animals with *L. tropica*, the question is put whether *L. tropica* may not be a variety of *L. donovani* or *L. infantum*, which has become adapted to certain conditions of existence or transmission that are different in some way from those obtaining in the case of these two parasites.

(77) LAFONT (A.) & HECKENROTH (F.). **Un Cas de Leishmaniose canine à Dakar.** [A Case of Canine Leishmaniasis at Dakar.]— *Bull. Soc. Path. Exot.* 1915. April 14. Vol. 8. No. 4. pp. 162–164.

The case recorded in this paper was observed in a native dog in French West Africa.

The animal was in very poor condition and was affected with mange. Numerous other ectoparasites were also found. At the post-mortem examination the liver was found to be enlarged and pale in colour, and the spleen was also enlarged. There were numerous tubercles in the lungs in which acid-fast bacilli were found. Smears from the spleen and liver showed the presence of numerous *Leishmaniae*, especially those made from the former. The bulk of the parasites were free, but macrophages and liver cells were both found containing them. In the liver smears there were also found cyst-like forms which appeared to be in a stage of multiplication. These cysts measured from 15 to 20 microns and contained from 2 to 10 parasites. The appearances of those in which only two or three were found suggested that some of the individuals had escaped from the cyst. The parasites are said to have closely resembled *Leishmania infantum*.

- (78) DI CRISTINA (G.) & CARONIA (C.). **Sulla Terapia della Leishmaniosi Interna.** [The Treatment of Internal Leishmaniosis.]—*Pathologica.* 1915. Feb. 15. Vol. 7. No. 151. pp. 82-83.

The authors state that they have had satisfactory results from the intravenous injection of antimony tartrate, the drug being used in a 1 per cent. solution and given on alternate days, commencing with a dose of 2 cg. and increasing to 10 cg.

- (79) GIUGNI (F.). **Sulla presenza della *Leishmania donovani* e sul suo sviluppo culturale dal sangue periferico nel Kala-azar.** [The Presence of *Leishmania donovani* in the Peripheral Blood and its Cultivation from it.]—*Malaria e Malat. d. Paesi Caldi.* 1915. Feb. 20. Vol. 6. No. 1. pp. 16-20.

The author records three cases in which the parasites could be detected by microscopic examination of the blood, but all attempts to obtain cultures from the peripheral blood failed.

- (80) PAVONI (G.). **Contributo allo Studio della Infezione Sperimentale del *Mus musculus* con *Leishmania tropica* e *infantum*.** [The Experimental Infection of Mice with *Leishmania tropica* and *Leishmania infantum*.]—*Pathologica.* 1915. March 1. Vol. 7. No. 152. pp. 114-116.

The author records the successful inoculation of mice with *L. tropica* and *L. infantum* by intraperitoneal and intravenous methods, but he has failed with subcutaneous inoculation. Thirty-two positive results were obtained with *L. infantum* and six with *L. tropica*. In a small number of cases lesions developed in connection with the skin after the lapse of some weeks. At first there was merely swelling and oedema of the skin, but a few days later these swellings became ulcerated and necrotic. Parasites could be found in liquid obtained from the oedematous swellings.

In those mice which did not develop skin lesions there was observed after an interval of about three months loss of hair and enlargement of the liver and spleen. The parasites were discoverable in these organs.

The experiments shed some light upon the question of the identity of the parasites responsible for Indian kala azar, infantile kala azar, and oriental boil.

- (81) DA SILVA (P.). **Expériences sur la transmission de la leishmaniose infantile par les Puces (*Pulex irritans*).** [Experiments on the Transmission of Infantile Leishmaniasis by Fleas (*Pulex irritans*).]—*Arquiv. Inst. Bact. Camara Pestana.* 1915. Vol. 4. No. 3. pp. 261-267.

In this paper the author records his experiments, in which a number of fleas were made to suck blood from a child that was seriously affected with kala azar. The fleas were fed upon the author for a period of at least a fortnight before being used and their faeces were carefully examined for the presence of any parasites resembling *Leishmania*. Five of the fleas originally collected were rejected on account of the presence of parasites of this type in their dejecta.

The fleas were fixed to threads in a manner similar to that adopted by NÖLLER, but silk was used in the place of silver wire. They were allowed to suck as long as they wished and were then incubated at 22° C.

All the dejecta passed by the fleas were very carefully examined microscopically after staining with Giemsa, and the fleas were kept alive for periods sufficiently long to allow any cycle of development to take place.

Twenty-five fleas were used, but in no case were *Leishmania* found in their faeces whether these were passed during the periods when the fleas were placed on the child or during the intervals.

- (82) YAKIMOFF (W. L.) & SCHOCKOV (N. F.). *Leishmaniose cutanée (bouton d'Orient), au Turkestan russe*. [Cutaneous Leishmaniasis (Oriental Boil) in Russian Turkestan.]—*C. R. Soc. Biol.* 1915. March 19. Vol. 78. No. 5. pp. 107-109.

The authors find that there are two varieties of *L. tropica* responsible for cutaneous lesions in Turkestan. To these they give the distinguishing names "*major*" and "*minor*."

L. tropica major.—The majority of the parasites are large and spherical. The cytoplasm often contains vacuoles and the nucleus, which is composed of separate granules, stains somewhat faintly. The blepharoplast may be either rod-shaped, circular, or curved, and stains more intensely.

L. tropica minor.—This parasite is generally shaped like a rice grain, but round and oval forms occur. The cytoplasm is compact and stains deeply. In it there can sometimes be seen small black granules resembling those seen in malarial parasites. The nucleus is oval or round, and compact in structure. The blepharoplast is rod-shaped.

The large forms may measure 5.5 microns but the small ones do not exceed 4 microns in their greatest diameter.

The Brazilian form of the parasite has not been observed. A mouse inoculated intraperitoneally with material derived from a lesion contracted generalised leishmaniasis.

Good results have followed the dusting of the lesions with medicinal methylene blue.

A dog was seen which had one lesion on the neck and one on the back. In these parasites measuring 8 microns were found.

SPIROCHAETOSIS.

- (83) ZINSSER (H.), HOPKINS (J. G.) & GILBERT (Ruth). *Notes on the Cultivation of Treponema pallidum*.—*Jl. Experim. Med.* 1915. Mar. 1. Vol. 21. No. 3. pp. 213-220. With 1 plate.

The authors confine themselves in this paper to a discussion of methods employed after a strain of the organism has once been obtained *in vitro*, leaving for a future report the subject of obtaining primary cultures from rabbits inoculated intratesticularly from human sources.

The strain used in these experiments was first passed under great pressure through a Berkefeld N. filter which had been used before, and it so happened that the treponema came through without any

bacteria. To test filtration as a method of isolation 44 filtration experiments of duration varying from one minute to two hours were carried out, but in no case were spirochaetes obtained without accompanying bacteria. The authors believe that these experiments prove that an ultramicroscopic form of the spirochaetes does not exist. The first pure cultures were obtained by Noguchi's method, employing heated human ascitic fluid mixed with agar after the addition of fresh rabbit kidney, the medium being covered with sterile paraffin oil. Successes were also obtained in gelatinised horse, ox, or sheep serum with and without the addition of tissue. It was necessary for other investigations to obtain large quantities of culture in a fluid medium, and the most successful method devised was the following:—Fluid serum-agar was poured into 200 cc. flasks to a height of about an inch. Pieces of sterile tissue were introduced and the medium inoculated. When the agar had set it was covered with a mixture of either salt solution and heated ascitic fluid, or slightly acid broth and ascitic fluid, up to the neck of the flask. A few pieces of sterile tissue were floated in the liquid, and a layer of paraffin oil was placed on the top.

Large quantities of growth were obtained in the liquid in from 2 to 4 weeks. Subsequently it was found to be unnecessary to use any agar, and for 6 months the strain has been maintained in serum broth mixtures with sterile rabbit kidney.

A number of experiments induced the authors to use heated tissue in the place of fresh tissue for addition to the medium. This was tried after the tenth culture generation and good growths were obtained. Cultures have been obtained in media composed of slightly acid meat infusion broth with heated sheep serum, together with autoclaved rabbit kidney, liver, spleen, brain, lung, heart, and skeletal muscle. It was also found that the tissue could be replaced by living *Staphylococcus aureus*, *Micrococcus candidans*, or other organisms. Finally the same strain was successfully cultivated in a simple medium composed of meat juice as obtained in the preparation of broth after autoclaving without other additions.

The authors do not think that the organism could have been cultivated in these media immediately after isolation. The ease with which cultures were obtained led them to take steps to make certain that *Treponema pallidum* was in reality the organism cultivated. Inoculation of rabbits before attenuation occurred had unfortunately been omitted, but comparison with three strains obtained from NOGUCHI confirmed the identity.

The treponemata are obtained by first centrifuging slowly to precipitate the clumps of coagulated protein, and then at high speed to collect the organisms. The yield may be increased by triturating the coagula in a mortar and treating them separately.

Lung tissue and supra-renal tissue appear to have been especially favourable tissues to use.

(84) WOLBACH (W. B.). On the Filterability and Biology of Spirochaetes.—*Amer. Jl. Trop. Dis. & Prevent Med.* 1915. Feb. Vol 2. No. 8. pp. 494–505. With 2 plates comprising 13 figs.

Spirochaeta duttoni.—In studying this parasite the author has employed the technique of which he published an account in the

Journal of Medical Research in 1914, and by means of which parasites can be stained in sections and their distribution accurately studied. The results obtained confirm those of MARCHOUX and COUVY, who worked with the spirochaete of the fowl in *Argas persicus*, in disproving that the granules found in the epithelial cells come from spirochaetes. The method also proves that spirochaetes migrate through all the tissues and the ova of ticks, and that all the phenomena of transmission can be explained by this fact alone. Coiled and "encysted" forms can be found in the muscular and connective tissues of ticks, but they probably have nothing to do with multiplication.

Since it was shown by TODD and WOLBACH that *S. duttoni* could be forced through a Berkefeld filter by a pressure of over 50 pounds to the square inch, the work in connection with the filterability of spirochaetes was carried on with free living spirochaetes—*S. elusa* and *S. biflexa*. *S. elusa* shows all the morphological characters presented by pathogenic spirochaetes including the coiled and "encysted" forms. All attempts to show that these latter forms had anything to do with reproduction or were even viable failed.

By repeated filtrations in series the author was able to get 100 per cent. of filtrates containing spirochaetes, the effect probably of a process of selection. By suitable technique he was also able to show the presence of spirochaetes in the thickness of the walls of the filter used. While repeated filtration increased the motility of the organism, direct subcultures gradually lost their power of movement.

The non-pathogenic spiral organisms isolated were capable of multiplying in and on artificial media with the production of visible colonies. On the other hand their morphological characters were very like those of the pathogenic spirochaetes and of *Treponema pallidum*.

TOXOPLASMOSIS.

- (85) LAVERAN (A.). *Nouvelle contribution à l'étude du Toxoplasma gondii*. [A Further Contribution to the Study of *Toxoplasma gondii*.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 58-63. With 1 text-fig.

In addition to the animals previously reported as having been proved susceptible to this parasite by experimental inoculation, the following have been successfully infected by the author:—dwarf mice, field mice, jerboa, and European dormice. Failure has followed the inoculation of small dormice (of Southern Europe and North Africa), a musk rat, and pigeon. Details of the various inoculations are given.

Attention is drawn to the fact that while mammals and birds can be successfully infected, closely allied animals such as the rat and the mouse, and the two kinds of dormice may be susceptible and insusceptible respectively. It is also stated that the parasite, which in 1913 was found to be of very low virulence for the pigeon, has completely lost its power of infecting that bird after numerous passages through the mouse.

Regarding the morphology of the parasite the author states that during his earlier observations on the parasite certain appearances were encountered which suggested that multiple division of the nucleus

took place. In preparations stained by the iron haematoxylin method groups of toxoplasms were found apparently enclosed in a cyst. Subsequent examinations showed that in reality these parasites were enclosed in cells the nuclei of which had not taken the stain. The author now expresses the view that in the multiplication of the parasite multiple division of the nucleus of the parasite does not take place.

Numerous preparations have been examined for the presence of a centrosome in the parasite, but none has been discovered. Nor has the author been able to see the least trace of a flagellum either in freshly obtained parasites or in parasites kept in a moist chamber for 48 hours.

A number of attempts to obtain artificial cultures have failed.

PROTOZOA.

- (86) WOODCOCK (H. M.) & LAPAGE (G.). **Observation on the Life-Cycle of a New Flagellate *Helkesimastix faecicola*, n. g., n. sp.: together with Remarks on the Question of Syngamy in the Trypanosomes.**—*Proc. Roy. Soc.* 1915. Feb. 1. Series B. Vol. 88. No. B 604. pp. 353–370. With 2 plates comprising 60 figs.

The flagellate described in this paper has been found in the faeces of the goat and sheep, and during its passage through the alimentary canal it appears to remain in an encysted condition. The cysts are spherical or ovoid, and measure about 3 microns in diameter. There is a distinct but not very thick wall which appears to be single. The protoplasm is homogeneous or finely granular, and the nucleus and sometimes a karyosome can be made out, but there is no vacuole. No division takes place within the cyst. In artificial cultures the cyst wall may disappear within about 22 hours and the parasite may become somewhat elongated after its disappearance. The wall does not rupture as is shown by the fact that no empty cyst is left behind when the parasite moves away. Excystment has only been observed in preparations in which aerobic bacilli were numerous present. The elongated parasite shows a minute contractile vacuole. Within a few minutes small jerky movements were seen, and a short flagellum projecting from about the middle of the body was observed. The parasite then increased somewhat in size, and the flagellum became longer and moved towards the anterior end of the body. Within about 20 minutes short gliding movements were observed and in an hour the parasite was seen to glide steadily out of the field of vision.

In the meantime the protoplasm had become granular and the nucleus could not be made out.

The active individual is described as being shaped rather like a carrot and measuring 6 to 7 microns in length by 2 to 2.5 in width. The single flagellum is two to three times the length of the body, is always directed backwards, and is dorsal in position. There is no centrosome.

Two types of movement are exhibited. One is seen when the organism glides along the surface of fluid, during which the only movements of the organism itself are slight jerky motions from side

to side made by the anterior end. Possibly surface tension plays some part in the production of this type of movement. When an individual is in the depths of a liquid medium undulating movements of the body and the flagellum are made.

After remaining active for some hours multiplication commences. An individual that is about to divide comes to rest and acquires a rounded shape, the flagellum being apparently lost. At this stage two karyosomes can often be seen in the nucleus. In a few minutes the body becomes elongated and then dumb-bell shaped and the nucleus divides, one part going into each end. About this time two new flagella appear, one towards each end and at opposite sides of the body. Ultimately the two parts separate from each other. The whole process takes from 15 to 30 minutes. In cultures multiplication goes on for two or three days, and then conjugation occurs. Actual conjugation has not been observed, but in preparations in which it has been effected the pairs of individuals generally have somewhat characteristic morphology. One is usually longer and not so plump-looking as the other, and the posterior extremity is turned slightly to one side. A foot-note states that it is considered that the tendency to adhere in couples is purely a matter of surface tension. A detailed description is given of the series of changes observed in a pair of these adherent and subsequently united individuals up to the time when by a process of shrinkage it becomes rounded in shape and provided with a cyst wall. Many hours appear to be necessary for the completion of the development. The biology of the parasite is to form the subject of further investigations, but it is said that repeated cultivations of the parasite while in the active condition leads to a loss of power of cyst-formation, the flagellates simply dying off after a time.

In some instances parasites with as many as five flagella and nuclei have been observed, these forms, however, do not become cysts, but divide. It is thought that they do not represent true syngamy, but are due to physical rather than vital factors. The authors think that the observations made on the non-conjugating strain, which they had cultivated through 35 generations during 20 weeks up to the time of writing, warrant the view that the power of cyst-formation and of undergoing true syngamy has been lost by it.

In the authors' view this has some bearing on the question of the absence of syngamy in trypanosomes, surfeit of nutrition and absence of any chemical substance to which flagellates react by conjugation explaining the absence of syngamy in the trypanosomes. The objections which may be raised are: trypanosomes may be inoculated indefinitely without showing conjugation; binucleate flagellates of insects have an alternation of hosts but it appears to be unlikely that syngamy will be observed in them. In the third place in the Haemosporidia, in spite of alternation of host, conjugation occurs.

(87) STEPHENS (J. W. W.) **On the Peculiar Morphological Appearances of a Malarial Parasite.**—*Ann. Trop. Med. & Parasit.* 1915. Mar. 18. Vol. 9. No. 1. pp. 169–172. With 1 coloured plate.

In this paper the author refers to and figures malarial parasites found in a film of blood taken from a child on the Gold Coast which resembled the parasite described by him as *P. tenue*. The slide in question was

prepared by Le FANU who noted the peculiarities of the organisms present in the blood before the author's description of *P. tenue* was published.

The following points are emphasised. The blood cells show no evidence of stretching or distortion, and the peculiar forms of the parasite occur in all parts of the film. Large, apparently normal, quartan parasites are present and it is possible to trace a transition from the normal ring forms to those in which only particles or strands of chromatin occur without any cytoplasm. Three views as to the nature of the parasite appear to be possible: that they are a new species; that they represent degeneration forms; that they are artificial forms produced outside the body under unknown conditions.

(88) FRANÇA (C.). *Quelques Observations sur le Genre Leucocytozoon.* [Some Observations regarding the Genus *Leucocytozoon.*]—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4. pp. 229-241.

The nature of the host cells of the *Leucocytozoa*.

The majority of the *leucocytozoa* are recognised by their sexual forms, and they can be divided into two groups based upon the appearance presented by the host-cells.

In the first group are the parasites which are oval in shape and are parasitic in cells which show fusiform prolongations. In the second group are the rounded parasites, the cell-hosts of which do not show such prolongations. The views that have been expressed by a number of observers regarding the nature of these host-cells are briefly recapitulated, and the author describes some of his own observations on the question.

He states that he has been able to establish the fact that the two types of *leucocytozoa* are in reality parasites of the red blood corpuscles, and that they are in fact *erythrocytozoa*.

With regard to schizogony in the *Leucocytozoa* the author concludes that, taking into consideration the observations of other investigators, the following facts may be considered as established:

Schizogony occurs in the internal organs and gives rise to a number of merozoites. The schizont does not possess any cyst wall. The processes of schizogony occur simultaneously in all the schizonts, so that in an infected animal in which the parasites are undergoing division all are in the same stage of multiplication. The periodic increase in the number of gametes of *L. caulleryi* in the blood of the host are explained by processes of schizogony.

The third section of the paper deals with the Genus *Leucocytozoon* and its characters.

The author thinks that although the parasites classed as *leucocytozoa* are in reality *haemocytozoa*, the name should be retained in spite of its being incorrect.

The adult gametes are of two distinct types morphologically and also in regard to the effect which they produce on the host cells. Structurally however the two types closely resemble each other.

The macrogametocytes of the round or of the oval type possess granular cytoplasm, and their nuclei, which are round, are composed of granules one of which is especially large and may be intra- or extranuclear in position. This granule is analogous in some of its characters to a blepharoplast.

The microgametocytes are also rounded or oval according to the species. They have a smaller amount of cell substance. Their nucleus is somewhat large, oval or irregular in outline, and shows no caryosome.

Ordinarily the parasites contain no pigment.

The microgametes closely resemble the corresponding stage of the plasmodia.

The genus *Leucocytozoon* should be included with the genera *Plasmodium*, *Laverania*, *Haemoproteus*, *Proteosoma*, and *Haemocystidium* in the family *Haemamoebidae* Ross.

- (89) MESNIL (F.). **Sur la Position Systématique des Hémosporidies.**
[The Position of the Haemosporidia in Schemes of Classification.]
—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4. pp. 241-244.

After discussing certain points raised in FRANÇA'S paper (see above) regarding the classification of these parasites, the author concludes that the Haemosporidia, or better the Haemocytozoa, comprise a number of parasites which have no common characters save those that are common to the Coccidia in general. This method of grouping is not longer permissible. The names Haemocytozoon and Leucocytozoon may be retained to designate parasites occurring in one or other type of blood corpuscle, but it must be understood that these names have no taxonomic value.

- (90) ADIE (Helen). **The Sporogony of *Haemoproteus columbae*.**—
Indian Jl. Med. Research. 1915. Jan. Vol. 2. No. 3. pp. 671-680.
With 3 plates.

The author's work was carried out in connection with the investigations of ACTON and KNOWLES [see this *Bulletin*, 1914. Vol. 2. p. 180], and the results supplement those of these authors.

The fly used in the experiments was *Lynchia maura* and a few details are given regarding the general characters of this fly.

The fly is a small hippoboscid with a small abdomen and long overlapping wings. The total length of a new born fly is 5.5 mm. and the wings measure 7 mm. The front of the head is characterised by projecting palps, enclosing the haustellum. The flies begin to deposit pupae about a week after they have hatched out, and the mature fly emerges from the pupa case after a period ranging from 31 days upwards depending upon the temperature. The fly will feed upon a pigeon within a few hours of hatching.

The fly cannot be kept without food for more than 48 hours, and there appears to be nothing that can be substituted for blood as food. Both sexes carry the infection.

The alimentary canal of the fly conforms to the general plan seen in bloodsucking flies.

The salivary glands, which are about 1 mm. in length by 0.2 mm. in width, occupy a ventral position in the abdomen. The ducts from these glands, which are lined by large epithelial cells, lead to goblet shaped bodies which are lined with small papillae. Beyond these structures the ducts are thicker walled and coiled, and they subsequently join and lead to the bulb. The parasite, the flagellating parasites, and the

vermicules have been described by other authors and no repetition of their morphological characters is given here.

The zygotes are generally found in the lower part of the mid-gut, not far from the Malpighian tubes. They range in size from 7.2 microns to large bursting cysts measuring 36.5 microns. In these larger parasites bundles of sporozoites can sometimes be seen. The zygotes contain rounded particles of pigment scattered through their substance. The sporozoites have been found in large numbers in the salivary gland-substance and also in the secretion from the glands. The sporozoites are the ordinary sickle-shaped bodies as found in *Proteosoma* and measure from 7 to 10 microns.

Brief details are given of experiments which showed that new-born flies can acquire the infection from infected pigeons and also that infected flies can transmit the infection to clean pigeons. These experiments also furnished evidence which appeared to contradict ARAGAO'S statement that if infected flies are fed for three days upon clean pigeons they cease to be infective.

- (91) GONDER (R.). *Zur Uebertragung von Haemoproteus columbae*. [The Transmission of *Haemoproteus columbae*.]—*Arch. f. Protistenk.* 1915. Mar. 1. Vol. 35. No. 3. pp. 316–323.

In this paper the author reiterates the views regarding the transmission of *Haemoproteus columbae* which he expressed at the International Medical Congress in London in 1913.

The conclusions arrived at as a result of his experiments carried out in 1910 in Africa may be summarised as follows:—

The parasite develops in the fly—*Lynchia capensis olfersia*—only as far as the ookinete stage, and flies remain infective so long as ookinetes persist in the stomach.

Flies become "clean" when they have a full meal on an uninfected pigeon, but the flies never become immune and can be reinfected. Flies cannot become "clean" when they feed upon infected pigeons.

The infection cannot be transmitted from pigeon to pigeon experimentally by inoculation with blood, but if the blood is first placed for a time in a moist chamber under conditions causing the production of ookinetes infection can be produced. It can also be produced by inoculating with materials derived from the lungs.

HELMINTHS.

- (92) GAIGER (S. H.). *A Revised Check List of the Animal Parasites of Domesticated Animals in India*.—*Jl. Comp. Path. & Therapeutics.* 1915. Mar. Vol. 28. No. 1. pp. 67–76.

"A preliminary check list was published in 1910 in the *Journal of Tropical Veterinary Science*, Vol. 5. No. 1. This list has now been considerably added to, revised, and corrected, and the older names by which parasites used to be known have been replaced by their more recent names."

- (93) SEURAT (L.-G.). **Sur l'existence en Algérie, du *Dermatoxys veligera* (Rud.) et sur les affinités du genre *Dermatoxys*.** [The Occurrence of *Dermatoxys veligera* (Rud.) in Algeria and the Relationships of the Genus *Dermatoxys*.—*C. R. Soc. Biol.* 1915. Mar. 19. Vol. 78. No 5. pp. 75–79. With 4 text-figures.

Dermatoxys veligera (Rud.).—The parasite is white in colour and has a cuticle marked with a fine transverse striation. The head is rather wider than the portion of the body immediately behind it. There are two large lateral alae which extend backwards as far as the bulb of the oesophagus. The excretory pore is very small and is situated just posterior to the bulb of the oesophagus. The mouth is margined by three lips each of which carries two papillae and on its inner face a tooth. The bulb of the oesophagus is devoid of any denticular apparatus which is so characteristic of the Oxyures. The oesophagus in the female measures $\frac{1}{5}$ the length of the body and in the male is rather longer. The nerve ring is placed in an anterior position. The male measures about 11 mm. in length and 435 microns at the thickest part. The body is straight or slightly curved at the caudal extremity. In addition to the cephalic alae there are two very long lateral wings on the posterior portion of the body which unite just in front of the extremity of the tail. The tail is regularly conical and the cloaca opens 400 microns in front of the extremity. At a point 700 microns in front of the cloaca there are 10 to 17 parallel cuticular ridges which are placed transversely in a manner resembling a curry comb. Between these ridges and the cloaca there are two rows of small projections.

The pericloacal area is covered with sessile papillae which nearly touch each other. In front of the anus there are six papillae, four of which are situated on the superior lip. The inferior lip shows three papillae of which the middle one is the largest. There are two large post-anal papillae.

The spicule is very small, measuring only 85 microns.

The female is about half as large again as the male. The conical tail is covered with a little sheath of brown chitin. The excretory pore opens 1.3 mm. from the bulb of the oesophagus. The vulva is not prominent and opens just anterior to the middle point of the body. The ovijector and the vagina have remarkably thick muscular walls. In its distal part the ovijector is related to a dark-coloured ovoid glandular structure.

The eggs are slightly flattened on one face and measure 110 by 50 microns. The inner surface of the shell is lined with a very distinct vitelline membrane and at one pole there is an area where the shell is less resistant.

The parasite occurs in the caecum of *Lepus kabilicus*.

- (94) RAILLIET (A.) & HENRY (A.). **Sur un Cénure de la Gerbille à pieds velus.** [A Coenurus of the Hairy-footed Gerbil.]—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4. pp. 173–177. With 3 text-figures.

This parasite was found in the abdominal wall of a Tunisian gerbil. It measured 12.5 by 10.5 millimetres and its outer surface was slightly bosselated. On opening the cyst the bosselations were found to be much more prominent on the inner face, and each of them showed a number of secondary prominences on their surface.

Examination revealed that each of these secondary projections contained an invaginated scolex which was provided with a double row of hooks and four rounded suckers. The paper contains a list of the coenuri known up to the present together with a tabulated statement regarding the number and size of the hooklets present in each.

The authors conclude that the cyst described is a new species and suggest the name *Coenurus* or *Multiceps glomeratus*.

(95) SEURAT (L.-G.). **Sur deux nouveaux Spiroptères des Carnivores.**
[Two New Spiroptera of the Carnivora.]—*C. R. Soc. Biol.* 1915.
Apr. 30. Vol. 78. No. 7. pp. 157-161. With 6 text-figs.

1. *Habronema grimaldiae* n. sp.—This parasite has been found in the oesophagus and stomach of the Algerian fox upon two occasions, and, in all, two females and four males have been examined.

The general characters of the species are:—The body is stout in comparison with its length in the posterior two thirds, but the anterior third is attenuated. The thick cuticle is transversely striated, the striations being 12 microns apart. There are two precervical papillae symmetrically placed slightly anterior to the nerve ring. The buccal cavity shows two lateral lips which have three teeth upon them, and a dorsal and a ventral lip the edges of which are hollowed out. The buccal cavity is short, but the oesophagus is long. In the female this amounts to $\frac{3}{8}$ of the total length and in the male to nearly half. The excretory pore opens immediately posterior to the nerve ring.

The female is about 22 millimetres in length and is 780 microns in thickness at the thickest part. The tail is short and conical. The vulva is small and not prominent. It is placed about the middle point of the body. The ovijector is directed backwards, the vestibule has thick muscular walls, and its small lumen contains about six eggs. The uterus is Y-shaped. The epithelial cells lining the unpaired branch appear to be in contact with each other obliterating the lumen, but the paired branches which are a little longer run backwards and contain a number of eggs in linear series.

The ovaries are slender and long. The eggs have thick shells, and contain mature larvae. They measure 52 by 31 microns.

The males measure about 15 millimetres in length and 370 microns at the thickest part. The tail is curved at its extremity. The cloaca which is bordered by rather prominent lips opens 330 microns in front of the posterior extremity. In the precloacal region the ventral aspect of the body shows a number of small longitudinal ridges. The caudal wings measure 1.5 mm. The dorsal aspect of these shows a very loose transverse striation, while the ventral aspect shows longitudinal striations placed much more widely apart.

There are six pairs of pedunculated papillae near the cloaca, three pairs of very small papillae just in front of the extremity of the tail, and a large unpaired papilla on the superior lip of the cloaca.

The spicules are not quite equal in length, and the longer one which is rounded at its extremity is thicker than the finer one which terminates in a point. The longer spicule is about 1.5 mm. in length.

Habronema nouveli n. sp.—Only the female of this worm is known, and of these six specimens have been found in the stomach and intestine of a genet killed near Algiers.

This parasite is white or pinkish in colour and has two lateral wings which begin 80 microns behind the head and extend to a point one millimetre in front of the anus. The cervical papillae are asymmetrically placed, the left being anterior to the right. The excretory pore is very distinct and opens on the ventral surface of the body posterior to the right cervical papilla.

The mouth is bounded by two lateral lips carrying three teeth which project slightly into the buccal cavity. The rim of the buccal cavity shows three pairs of papillae.

The female is about 15 millimetres in length and has a short conical tail which is truncated obliquely, the truncated part showing about a dozen little prominences arranged in a circle. The oesophagus is about "1/5, 7" the length of the body, and the vulva, which is difficult to make out, opens immediately anterior to the middle point of the body. The ovjector exactly resembles that of *Habronema chevreuxi*.

The extremities of the branches of the uterus form S-shaped curves. The oviducts are 800 microns in length and the ovaries 3.5 mm. in length and narrow.

The eggs are elliptical, possess thick shells, and measure 38 by 20 microns.

The male parasite is unknown.

(96) SEURAT (L.-G.). **Sur deux nouveaux parasites du Renard d'Algérie.** [Two New Parasites of the Algerian Fox.]—*C. R. Soc. Biol.* 1915. Apr. 2. Vol. 78. No. 6. pp. 122-126. With 4 text-figs.

Spirocerca subaequalis Molin.—A single female of this species was found in a tumour near the pylorus of the stomach of one of two Algerian foxes examined. (For a description of this parasite see this *Bulletin*. Vol. 1. No. 5. Dec. 1913. p. 312. In the original of the paper there abstracted the author referred to the parasite as *Spiroptera subaequalis*.)

The other parasite, *Allodapa numidica* n. sp., was found in the caecum. In one of the foxes there were 88 females and 34 males, and in the second one male and three females were found.

The general characters of this species are as follows:—

The body is straight and slender except for a curving of the tail in the male. The cuticle is thick and very closely striated transversely. There are no cephalic alae. The excretory pore opens on the middle line of the ventral surface not far from the nerve ring.

There are two lateral lips to the mouth, but they are not very well marked. Each carries three papillae. The buccal cavity is divided into two portions. The upper part is bounded by a thick chitinous wall, while the lower portion, which has equally thick walls, has three slightly projecting teeth marking the entrance to the oesophagus.

The oesophagus is slightly swollen in the posterior part and connects by means of a constricted part with a distinct bulb containing the teeth.

The male worm measures from 13.5 to 18 mm. in length and 370 microns at its thickest part.

The tail may show either a slight curve or a complete turn. The cloaca has prominent lips. The caudal alae are very small. On the

ventral surface there is an oval area showing marked transverse striation and surrounded by series of rectangular plates of cuticle. There are four pairs of pre-anal and six pairs of post-anal papillae. The caudal glands open immediately behind the second pair of papillae.

The spicules measure 600 and 440 microns in length. The large one is striated transversely and its free portion is thickened.

The female measures about 25 mm. in length. The excretory pore opens 600 microns from the cephalic extremity. The vulva is prominent and opens immediately in front of the junction of the anterior and middle thirds of the body. It is connected with an ovijector 1 mm. in length. The ovijector has very thick walls and is lined with cuticle continuous with the external cuticle.

Three parts of the sphincter are distinguishable. The first part has a very thick cuticular lining, the middle portion has a number of elongated cells placed transversely between the muscular coat and the lining, and in the third portion the muscular coat gradually diminishes in thickness.

The branches of the uterus are very long and are folded upon themselves a number of times.

There is no distinct seminal vesicle. The ovaries are about 4.5 mm. in length and are placed one immediately in front of and the other immediately behind the vulva.

The eggs have thin envelopes and measure 63 microns in diameter. They are nearly round, and contain mature embryos.

BITING FLIES.

- (97) ROUBAUD (E.). **Sur un essai d'élevage de Glossines dans les laboratoires d'Europe.** [An Attempt to raise Glossinae in the Laboratories of Europe.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 34-36.

This paper contains what appears to be the first record of attempts to raise Glossinae in European Laboratories. The author who returned from Senegal in December 1913 brought with him about a score of pupae belonging to the species *G. palpalis* and *G. morsitans*. The older pupae were killed off by the cold during the winter, but the younger ones survived and a certain number of adults were hatched out in the Pasteur Institute. The flies were kept in incubators at 24-25° C. and were fed daily upon guinea-pigs or rabbits.

Only two specimens of *G. palpalis* were obtained and both of these were males. These flies lived for about five weeks, but the absence of any females made it impossible to raise a fresh generation.

The pupae of *G. morsitans* gave rise to two males and six females. One of these flies formed the starting point of a strain which had at the time of writing been maintained for a year. The conditions under which the flies were kept were: a temperature of 24° to 25° C. and an average humidity of 50-55 per cent. At this temperature a larva was produced every 10 or 11 days, and one of the flies dropped as many as 14.

The duration of life of the flies varied from three weeks to five-and-a-half months, and the period elapsing between the formation of the pupa and hatching was from four to five weeks. The total number of descendants obtained from one of the flies during the course of the year was only twenty, but a number were lost through accidental causes during the months of August and September.

It is said that to raise the flies satisfactorily in incubators there must be some means of ventilating them so as to obtain a change of air, as otherwise the development is poor. In the case of *G. morsitans* a higher percentage of moisture than 60 is to be avoided.

During June some of the flies were exposed to a temperature of 10° to 27° C. for a period of a week and they survived, but the author thinks that Glossinae would never survive in Europe under natural conditions.

RABIES.

- (98) MOON (V. H.). **Further Observations on the Effect of Quinin in Rabies.**—*Jl. Infect. Dis.* 1915. Jan. Vol. 16. No. 1. pp. 58–62.

The author gives a summary of seven groups of animals—rabbits and dogs—which were infected experimentally with rabies (street virus) and treated with quinine either by the mouth, or by subcutaneous and intravenous injection.

A brief account is also given of two cases of rabies in the human subject which were subjected to treatment along the same lines. In both of these cases the disease was somewhat far advanced when treatment was resorted to.

The conclusions may be summarised as follows:—

Quinine is not constantly effective either as a cure or as a protective agent in rabies in animals, and when given in the later stages of cases of the disease in man it produces no significant results. It would appear to have the effect of retarding the development of the disease if given in large dose during the period of incubation.

- (99) KRUMWIEDE (C.) JR. & MANN (Alice G.). **The Effect of Quinin on Rabies.**—*Jl. Infect. Dis.* 1915. Jan. Vol. 16. No. 1. pp. 24–25.

The experiments recorded in this paper were carried out to check the results published by MOON in 1913. Owing to the results obtained the work was discontinued, but the negative results published by CUMMINGS, and by FROTHINGHAM and HALLIDAY, warrant the publication of the authors' results.

A number of rabbits were inoculated intracranially with fixed virus and were subsequently treated with quinine, the treatment being started on different days after the inoculations. Quinine bisulphide was used in a 1 to 8 solution in water and it was administered by injection, but it is not stated by what path the injections were given. Some of the rabbits were killed with quinine.

The quinine did not appear to have the least effect upon the course of the disease.

Six dogs which had been inoculated intracranially with street virus were also subjected to treatment with quinine, but save for one case in which the period of incubation was rather prolonged, although not beyond what is seen in natural cases, and one case in which there was a remission during the course of the disease, all the animals reacted in a normal way and died. The virus obtained from these dogs was pathogenic for guinea-pigs, and typical Negri bodies were found in the brain tissue of each one of the dogs.

MISCELLANEOUS.

- (100) GRIFFITHS (J. A.). **Demodectic Mange of Domesticated Animals in Nyasaland.**—*Jl. Comp. Path. & Therapeutics*. 1915. Mar. Vol. 28. No. 1. pp. 61-64. With 1 text-fig.

The disease appears to have been first recognised about five years ago, but it is probable that it was introduced by imported animals some years previously.

Practically all the cases that have been seen have occurred in the Shire Highlands, where the disease has been found in cattle, sheep, pigs, dogs, and cats. It is, however, among cattle that the greatest amount of infection has been found.

The first evidence of infection is the appearance of a crop of nodules on the skin, generally in the neck and shoulders. These gradually spread to the rest of the body, and in neglected cases tend to coalesce and burst, discharging purulent contents. The inflammation resulting causes the skin to become harsh, wrinkled, and denuded of hair.

The disease may persist in the nodular stage without material alteration for periods extending to 18 months or even longer. Affected animals may become very emaciated and in some cases this emaciation may lead to a large percentage of deaths.

Treatment has been limited to prophylactic measures, save for the spraying or dipping of animals that are not sufficiently seriously affected to warrant their slaughter.

In pigs and sheep the nodular condition is not seen, but small pustules make their appearance and subsequently coalesce. There may be very marked emaciation, and many animals die.

In the dog and the cat the disease makes its first appearance on the ears, but subsequently it spreads to the rest of the body.

In those cases in cattle in which the contents of the nodules are purulent rather than cheesy the course of the disease is generally more rapid, and death more commonly occurs.

- (101) PINOY (E.) & MASSON (P.). **Mycétome du poumon chez l'âne.** [Mycetoma of the Lung in the Donkey].—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 11-12.

The parasite was discovered in a tumour-like growth in the lung of a donkey, and on examination it appeared to be identical with that described by GRIJNS as an ascosporeous form of *Aspergillus fumigatus*.

- (102) KERANDEL (J.). **Insectivore réservoir de virus de la peste au Cambodge.** [An Insectivore as a Reservoir for the Virus of Plague in Cambodia.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 54-57.

A musk rat (*Crocidura murina*), which was found dead in a house where a case of plague had occurred, proved to be infected with an organism which the author identified as the plague bacillus on the grounds of cultural and experimental inoculation results. Examination of musk rats showed that *Laemopsylla cheopis* was more numerous on them than on rats in the same district.

The conclusion drawn is that *Crocidura murina* may act as a reservoir for the virus of plague in exactly the same way as the rat.

- (103) NÈGRE (L.) & BOQUET (A.). **Sur la culture du parasite de la lymphangite épizootique.** [The Cultivation of the Parasite of Epizootic Lymphangitis.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 49-52. With 6 text-figs.

In this paper the authors describe some further investigations regarding the cultivation of the cryptococcus. (For previous communication see this *Bulletin*, Vol. 2. No. 3, p. 152.)

The following media have been used:—Coagulated horse or sheep serum to which 6 per cent. of glycerin was added, horse serum agar, ordinary peptone agar, bean agar (gélose au haricot) containing 2 per cent. of glucose and not neutralised. The pus was sown out in the water of condensation of these media to which were added about 20 drops of unneutralised bean broth containing 2 per cent. of either glucose, lactose, or saccharose.

Two forms of development have been observed. On the second or third day some of the cryptococci increase in size and show in their interior a variable number of droplets of oil. These give rise to a number of buds which are divided off from the parent organism by septa. The buds increase in length and become segmented into a series of elements, and from these secondary septate threads are given off. The threads do not as a rule exceed 15 microns in length, but exceptionally they may be as long as 30 microns. Their breadth varies from 2 to 4 microns. There is a distinct double contour and the hyphae show at intervals swellings which may measure 10 microns in diameter. The organisms are difficult to stain.

The mycelial forms described by TOKISHGE and MARCONE make their appearance in a week to a fortnight. Since intact cryptococci and large forms containing droplets of oil may be present at the same time, it is probable that the filaments present in cultures of the second and third generation are not derived from the previous mycelial forms but by a delayed vegetation of cryptococci.

In other cryptococci it was observed that 48 hours after inoculation they had become enlarged and rather rounded in shape, and that the double contoured envelope had an irregular outline. The protoplasm was slightly granular, but did not contain any droplets of oil. Parasites of this type measured from 4 to 6 microns in diameter. Some of them showed a delicate septum across the centre.

These forms were always adherent to the surface of the medium while the mycelial forms were always free in the liquid. The rounded forms resisted all efforts to stain them.

The optimum temperature for growth is between 20° and 30° C. The best media were coagulated horse and sheep serum to which glycerin had been added.

(104) TERRY (B. T.). **Different Amounts of Transformed Atoxyl produced by incubating one per cent. and ten per cent. Atoxyl in Blood.**—*Jl. Experim. Med.* 1915. Mar. Vol. 21. No. 3. pp. 258-266.

The Summary of this paper is as follows:—

“ 1. Ten per cent. atoxyl in blood incubated at 37° C. for 1 hour gives rise to a solution that is much more than ten times as toxic as a 1 per cent. solution of atoxyl similarly incubated.

“ 2. When the comparison is made after incubation for 3 hours instead of for 1 hour, the toxicity of the 10 per cent. solution is but slightly greater than ten times that of the 1 per cent., provided the red blood corpuscles are not removed from the dilutions.

“ 3. If the corpuscles are removed from both the 10 per cent. and the 1 per cent. atoxyl solutions immediately after incubation at 37° for 1 to 3 hours, the dilutions of the 10 per cent. atoxyl are much more than ten times as toxic as the corresponding dilutions of the 1 per cent. atoxyl.

“ 4. After incubation with atoxyl at 37° for 1 to 3 hours, red blood corpuscles left at room temperature in dilutions made from the 10 per cent. and 1 per cent. solutions in blood increase markedly the toxicity of the dilutions made from the 1 per cent. atoxyl, but increase very slightly the toxicity of the dilutions made from the 10 per cent. atoxyl.

“ 5. If one desires to produce a large amount of transformed atoxyl by incubating atoxyl in blood at 37° for 1 to 3 hours, strong solutions of atoxyl should be chosen in preference to weaker solutions.”

(105) TERRY (B. T.). **The Effect of Heat on the Transforming and Binding Power of Blood.**—*Jl. Experim. Med.* 1915. Mar. Vol. 21. No. 3. pp. 267-279.

Summary:—

“ 1. The transforming power of red blood cells for atoxyl is apparently uninfluenced by a preliminary heating of the blood for 30 minutes at 50° C., but a temperature of 55° C. acting for 30 minutes destroys this property of blood almost completely.

“ 2. When the heating was for 60 minutes, 54° C. and higher temperatures apparently destroyed all the transforming power.

“ 3. After heating for 10 minutes, 70° C. destroyed almost all the transforming power, and 100° C. seemingly destroyed all.

“ 4. Under the influence of certain temperatures blood seemingly binds transformed atoxyl, and under the influence of other temperatures frees it again. A temperature of 70° C. for 10 minutes applied to blood subsequent to its incubation with atoxyl causes nearly all the toxicity of the solution to disappear. On the other hand, a temperature of 100° C. for 10 minutes applied to blood subsequent to incubation with atoxyl leaves the solution almost as toxic as if the blood had not been heated at all after the incubation.

“ 5. Some of the transformed atoxyl bound by blood when it is heated to 70° C. for 10 minutes is freed if the heating at 70° C. is prolonged to 30 minutes.

“ 6. Blood which has bound transformed atoxyl gives up most, but not all, of this toxic substance when heated to 100° for 10 minutes. All, or nearly all, is freed when the heating at 100° C. is continued for 30 minutes.

" 7. Under the influence of 70° C. for 10 minutes transformed atoxyl may be made to enter blood corpuscles, for the fluid above these corpuscles is rendered non-toxic and does not become toxic again when heated to 100° for 20 minutes, provided it contains no laked blood. The blood corpuscles, on the other hand, when heated to 100° for 20 minutes, in contact with fresh salt solution, make this solution quite toxic.

" 8. Laked blood in contact with transformed atoxyl behaves like unlaked blood when heated to 70° C. and to 100° C. for 10 to 30 minutes.

" 9. The toxic substance can be concentrated by heating the blood corpuscles in contact with transformed atoxyl to 70° C. for 10 minutes, centrifugalizing, removing a large part of the supernatant fluid, and then heating to 100° C. for 30 minutes.

" 10. The power of blood to take up and bind transformed atoxyl is destroyed apparently completely by heating blood to 100° C. for 10 minutes.

" 11. The toxic substance into which atoxyl is transformed (transformed atoxyl) is thermostabile, but the transforming agent in blood is thermolabile."

(106) HENRY (M.). **Mortality among Cattle in the Bega District of New South Wales.**—*Vet. Jl.* 1915. Feb. Vol. 71. No. 476. pp. 62-72.

In this paper the author describes a peculiar disease among cattle which has occurred during February and March each year since 1912. The majority of the animals affected were cows in full milk, and it was only in those areas in which the country was very poor that cases occurred in animals other than milking cows. It also appeared that the disease caused greater losses on farms where attempts had been made to improve the milking capacity of the animals by the importation of Jersey bulls and by other means.

Generally speaking the area affected has steadily increased, but it was noted that in areas where recurrence of the disease did not occur the food supply, which was in general limited to grazing on land greatly infested with rabbits, had been improved. In every case the disease disappeared with the onset of rain. On all the affected farms depraved appetite was common among the cattle, they would chew bones, stocks, dead rabbits, and would eat indigestible and astringent plants.

The affected animals rapidly lost condition and lactation ceased somewhat suddenly. There was evidence of dull abdominal pain, the animals moved stiffly, and in the later stages lay on their sides. The tongue was protruded, salivation was free, and the muscles of mastication and deglutition were paralysed. Death occurred in from 12 hours to a fortnight after symptoms had been observed. Recovery was not common.

The post-mortem appearances were very indefinite and inconstant.

Infection as a causal factor in the production of the disease appears to be excluded. Mortality ceases when cattle are moved from affected to non-affected areas, and animals with which they are mixed do not contract the disease. A fall of rain and improvement in the feeding bring the disease to an end. No known poisonous plant could be detected on affected areas, nor could any fungus on the grass be implicated.

It was particularly noted that the disease occurred where bone chewing and osteomalacia had been previously observed.

Chemical analysis of soils and grasses appeared to indicate a definite connection between poverty of the soil and of the food, and also between poverty of the food and the mortality.

The author inclines to the view that the disease is a deficiency disease, and reference is made to STEAD'S statement in connection with lamzieke to the effect that milk contains a substance which possesses protective properties, and draws attention to the fact that in one instance mortality which was very high in a herd of cows suckling their calves rapidly ceased when the calves were weaned.

(107) GRAYBILL (H. W.). **Repellents for protecting Animals from the Attacks of Flies.**—*U. S. Dept. of Agric. Bulletin No. 131.* 1914. 26 pp.

The following is an abstract of the general summary of the matter contained in this *Bulletin* :—

In the United States the principal flies which cause annoyance to cattle are *Stomoxys calcitrans* and *Lyperosia irritans*, and there are certain other flies which, although they do not bite, cause a considerable amount of unrest among animals.

It is thought that the losses generally attributed to the biting flies are exaggerated to some extent.

One author records that flies object to a blue colour, and that they can be banished from cattle sheds by colouring the walls with a blue-coloured wash. It does not appear that this observation has been corroborated. It has been noted by a number of observers that dark coloured animals are more troubled by flies than light coloured ones.

Internal medicaments appear to be of no value as repellents.

Liquids may be applied to the skins of animals by dipping, spraying, or by painting, the method adopted depending upon the nature and the cost of the material used.

Powdered drugs such as pyrethrum are of very little value.

Fish oil is said to be very effective, and it may be used in conjunction with such materials as oil of tar, crude carbolic acid, and kerosene. Such mixtures may be effective for as long as a week. They should be applied lightly with a brush, but they are not safe when used liberally with a spray pump. Pure laurel oil is effective but irritant. Ten per cent. laurel oil in cotton seed oil was found by the author to be ineffective.

Various mixtures of carbolic acid and pine tar in cotton seed oil were found to exercise a repellent action, but they were not effective for more than a day. Oil of tar in cotton seed oil and in Beaumont oil is effective, but such mixtures are not safe to apply liberally if there is 50 per cent. of oil of tar present. The mixtures containing 10 per cent. of oil of tar must be applied every day.

A heavy application of fish oil causes the hair to become sticky and fall out, but a light application does not produce these results.

(108) GRAYBILL (H. W.). **The Action of Arsenical Dips in preventing Tick Infestation.**—*Jl. of Parasitology.* 1914. Sept. Vol. 1. No. 1. pp. 48-49.

A previous paper by the author on this subject was published by the Bureau of Animal Industry in 1913 [see this *Bulletin*, Vol. 1, No. 5, Dec. 1913, p. 318], and the results obtained in the experiments

recorded in that paper showed that cattle dipped in an arsenical dip are protected from becoming infested with ticks for two days, but not for five.

The experiments referred to in the present communication were carried out with the object of ascertaining whether such dipping confers any protection for three or four days, and whether any mortality occurs among ticks placed upon or maturing upon immune animals that have been dipped on a number of occasions at intervals of one or two weeks.

The dip used contained 8 pounds of white arsenic to 500 gallons, but no pine tar was mixed with it.

In the first experiments non-immune calves had placed upon them seed ticks at intervals of three and four days after dipping, other similar calves being left as controls. It was found that while the animals were not absolutely protected from the ticks the infestation in the dipped animals was lighter than in the controls, and, in view of the fact that no dead nymphs were found, it would appear that the lighter infestation was due to an action of the dip upon the larvae.

The second experiment was primarily intended to show whether ticks that have matured on animals that have been regularly dipped show any mortality after dropping off.

Immune calves were divided into three groups. One group was dipped four times at intervals of two weeks, a second group was dipped four times at intervals of one week, and the third batch were left as controls. The ticks were applied five days after the last dipping. The results showed that the dipping does not prevent infestation entirely, but that it reduces it to some extent when the animals are dipped at intervals of a week. The ticks collected showed no abnormality in connection with oviposition and the number of eggs hatching, and the mortality was normal.

- (109) CHAPIN (R. M.). **Arsenical Cattle Dips : Methods of Preparation and Directions for Use.**—*U.S. Dept. Agric. Farmers' Bulletin 603.* 1914. Aug. 14. 16 pp.

This bulletin contains a brief but general summary regarding the preparation and management of arsenical dipping solutions, and is written for the use of the farmer.

The following subjects are dealt with : substances used for making dips and their properties, including antidotes to be used in cases of poisoning ; the general composition of dips and the methods of preparing. Diluting the dip, replenishing the bath, correcting the strength, calculating the capacity of a vat, and the safe disposal of waste arsenical baths are also dealt with.

- (110) KOLMER (J. A.). **A Method of transmitting Blood Parasites.**—*Jl. Infect. Dis.* 1915. Mar. Vol. 16. No. 2. pp. 311-312.

This short paper contains a description of a method by which blood can be drawn from the heart of living rats without causing any disturbance of health. The skin over the heart is sterilised with tincture of iodine and a sharp syringe needle of suitable size is used to puncture the heart, the blood being withdrawn into a syringe containing citrate solution. In this way practically all chance of contamination is avoided.

- (111) BOQUET (A.). **Sur les Principales Affections Contagieuses des Animaux de l'Afrique du Nord.** [The Principal Contagious Diseases of Animals occurring in Northern Africa.]—*Bull. & Mém. de la Soc. des Sci. Vet. de Lyon.* 1914. July 2. 30 pp. With 8 figs.

Solipeds:—

Epizootic Lymphangitis.—The author summarises our knowledge regarding this disease and confirms its occurrence in Algeria, Morocco, and Tunis.

Dourine.—This disease has a wide distribution in Algeria. It is most frequently the chronic form which comes under observation. The usual three stages of oedema, plaques, and progressive paralysis are observed. The period of incubation is generally two to three weeks. During the third stage superficial abscesses and conjunctivitis and ulcerative keratitis are seen. Fractures of the limbs are common. In the acute form of the disease the symptoms develop rapidly and death may take place a few days after the onset of locomotor disturbance. Exceptionally horses recover spontaneously, but in the donkey recovery is far more frequent.

The author gives a text-figure of a trypanosome dividing into four daughter trypanosomes.

Taher—Mal de la Zousfana—Debab.—This disease has also a wide distribution. It is characterised by loss of appetite, weakness, and short attacks of high fever. There is progressive paralysis, and at times haematuria is observed. Death generally takes place in from 4 to 6 months. The causal trypanosome is present in the blood in large numbers, and is identical with that causing debab in dromedaries. The latter animals form the reservoir of the virus, and the infection is transmitted from them to horses through the medium of biting flies.

Piroplasmosis.—Acute, sub-acute and chronic cases of this disease are encountered. The causal parasite is *P. equi* and the disease is transmitted by Ixodes. Intramuscular injections of biniodide of mercury and trypanblue (4 to 6 g. in 1 per cent. solution in water) have yielded good results in the treatment of the condition.

Cattle:—

Piroplasmosis.—It would appear that more than one kind of piroplasmosis occurs among cattle in Algeria, as the author refers to the occurrence of parasites closely resembling *P. bigeminum* and also to organisms that are rod-shaped. It is also said that in some animals 60 to 80 per cent. of the blood corpuscles may be invaded without the animals showing any symptoms. Anaplasma also occurs in Algeria.

Black Quarter.—This disease is stated to be one of the most serious occurring in Algeria, but good results have followed the application of different methods of vaccination. Especially good results have been obtained with the method of LECLAINCHE and VALLÉE.

Sheep Pox.—This disease appears to be less severe during the summer than during the autumn and winter. The mortality ranges on an average from 6 to 10 per cent., but occasionally may be as high as 30 per cent. In young lambs more than 50 per cent. sometimes die. The disease causes great loss of condition and the period of convalescence is very prolonged. Pregnant animals frequently abort, and the secretion of milk is to a great extent suppressed.

Owing to the risks attaching to the importation of sheep from Algeria into other countries a method of vaccinating has been devised. The vaccine consists of a sensitised virus prepared by mixing material containing the virus with anti-pox serum prepared in the manner devised by BORREL, and incubating the mixture for 3 to 5 days at 18-20° C. The mixture is then centrifuged and the sediment added to salt solution in the proportion of 0·005 g. to 0·1 g. per cubic centimetre. This material is injected deeply into the skin behind the shoulder and produces on the fifth or sixth day an area of oedema varying in size up to the palm of the hand. In two or three days this decreases and a little nodule about the size of a nut is left. The method causes no disturbance of health and immunity is complete by the third day and lasts for a year.

The disease occurs in a more serious form in Morocco than in Algeria.

El R'och.—This is a disease of the sheep which is characterised by symptoms of anaemia and progressive cachexia. In the author's view a bacillus of the Preisz-Nocard type, which he has been able to isolate in pure culture from the heart blood, is possibly the cause of the condition.

Bou Frida of Goats.—This name is used to designate a disease of the goat which takes the form of an epizootic pleuro-pneumonia, but it is probable that more than one condition is included under the term. The mortality may reach 60 per cent.

El Debab of Dromedaries.—This disease is caused by a trypanosome *T. berberum*—discovered by the brothers SERGENT in 1904. It is encountered throughout the whole of the northern countries of Africa. According to the describers two species of fly are concerned in the transmission of the trypanosome—*Atylototus tomentotus* and *Atylototus nemoralis*, which are active principally during the month of June.

The disease is frequently responsible for abortion in the female.

Leishmaniasis of the dog.—This disease has been detected in 2·5 per cent. of the dogs killed at the public slaughter-houses, and the author states that infantile kala azar has been found in every place where the condition has been detected in the dog. The course of the disease varies from a few weeks to 15 or 16 months. Transmission is effected through the medium of fleas.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 3, No. 1, pp. 39-40.]

Leishmaniasis.

- (112) LIGNOS (A.). Quelques nouveaux cas de guérison de Kala-Azar infantile observés à Hydra. [Some Fresh Cases of Recovery from Infantile Kala-Azar on the Island of Hydra.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1, pp. 25-28.

Rabies.

- (113) PHISALIX (Mme. M.). Mécanisme de la résistance des Batraciens et des Serpents au virus rabique. [The Mechanism of the Resistance offered by Batracians and Serpents to the Virus of Rabies.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1, pp. 13-16.

Tick Paralysis.

- (114) STRICKLAND (C.). Note on a Case of "Tick-Paralysis" in Australia.—*Parasitology.* 1915. Mar. Vol. 7. No. 4, p. 379.

Trypanosomiasis.

- (115) AUBERT (P.). Essais de traitement de la trypanosomiase humaine par les dérivés du Diaminoarsénobenzene O₁ et OK₁. [Attempts to treat Human Trypanosomiasis with the Derivatives of Diaminoarsenobenzene O₁ and OK₁.]—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4, pp. 169-172.

Undulant Fever.

- (116) BULLETIN DE L'OFFICE INTERNATIONAL D'HYGIENE PUBLIQUE. 1915. Feb. Vol. 7. No. 2, pp. 255-299, & Mar. No. 3, pp. 485-501.—Fievre Ondulante. [Undulant Fever.] i. by JORGE (Ricardo), ii. by SERGENT (Edm.) & NEGRE (L.), iii. by de COTTES (J. Duran), iv. by SANTOLIVIDO, v. by NICOLLE (Ch.).

Biting Flies and Ticks.

- (117) CARTER (H. F.). On Some previously Undescribed Tabanidae from Africa.—*Ann. Trop. Med. & Parasit.* 1915. Mar. 18. Vol. 9. No. 1, pp. 173-196. With 9 text-figs. & 1 plate comprising 6 figs.
- (118) CRAGG (F. W.). A Preliminary Note on Fertilization in Cimex.—*Indian Jl. Med. Research.* 1915. Jan. Vol. 2. No. 3, pp. 698-705. With 1 plate comprising 2 figs.
- (119) CRAGG (F. W.). The Alimentary Tract of Cimex.—*Indian Jl. Med. Research.* 1915. Jan. Vol. 2. No. 3, pp. 706-720. With 2 plates & 2 text figs.
- (120) CUNHA (R. de A.). Contribuição para o conhecimento dos sifonapteros brasileiros. [The Brazilian Siphonaptera.]—*Mem. Inst. Oswaldo Cruz.* 1914. Vol. 6. No. 2, pp. 124-136. With 2 plates & 3 text-figs.
- (121) HADWEN (S.). Warble Flies. A Further Contribution on the Biology of *Hypoderma lineatum* and *Hypoderma bovis*.—*Parasitology.* 1915. Mar. Vol. 7. No. 4, pp. 331-338.
- (122) HARRISON (L.). On a New Family and Five New Genera of Mallophaga.—*Parasitology.* 1915. Mar. Vol. 7. No. 4, pp. 383-407. With 2 plates & 3 text-figs.
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- (202) RODHAIN (J.). Note sur la ponte des Oestrides des genres *Gyrostigma* et *Cobboldia*. [Note on the Oviposition of the Oestridae of the Genera *Gyrostigma* and *Cobboldia*.]—*Bull. Soc. Path. Exot.*, 1915. May. Vol. 8. No. 5, pp. 275-279. With 1 fig.
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- (205) STRICKLAND (C.). The Comparative Morphology of the Anophelines *Nyssomyzomyia ludlowi*, Theo., and *N. rossi*, Giles.—*Bull. Entomol. Research*, 1915. Mar. Vol. 5. No. 4, pp. 321-324. With 2 text figs. & 2 plates.
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- (209) NICOLL (W.). The Trematode Parasites of North Queensland. III. Parasites of Fishes.—*Parasitology*, 1915. June. Vol. 8. No. 1, pp. 22-40. With 2 plates comprising 11 figs.
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- (211) SEURAT (L.-G.). Sur les Rictulaires des Carnivores du Nord-Africain et les affinités du genre *Rictularia*. [The Rictulariae of the North African Carnivora and the Relationships of the Genus *Rictularia*.]—*C. R. Soc. Biol.*, 1915. June 25. Vol. 78. No. 11, pp. 318-322. With 3 text-figs.
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- (213) CHATELAIN (M.). Sur le traitement de la Lymphangite Epizootique. [The Treatment of Epizootic Lymphangitis.]—*Rev. Gén. Méd. Vét.*, 1915. July 1. Vol. 24. No. 284-285, pp. 387-392.
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For CONTENTS, see pages 3 & 4 of Cover.

pp. 81-116.]

[Sept. 30, 1915.

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Vol. 3.

1915.

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[No. 4.

TRYPANOSOMIASIS.

(217) **Reports of the Sleeping Sickness Commission of the Royal Society.**—No. XVI. viii + 221 pp. with plates & maps. 1915. London: Printed under the authority of His Majesty's Stationery Office. [Price 8s.]

The majority of the papers included in this report have already been published elsewhere, and abstracts of these have appeared in this *Bulletin*.

The introduction contains the names of the members of the Commission, and a brief description of the headquarters at Kasu. There is also included a summary of the work done and a review of the practical recommendations that arise out of it. These are: That every effort should be made to diminish the number of wild animals in the fly-areas; That infected natives should be moved into fly-free areas; That the land around villages should be cleared; That prophylaxis and drug treatment are at present of little value; and That the fly cannot be attacked directly.

As a result of the examination of small mammals living in the Proclaimed Area the conclusion is arrived at that these do not constitute a source of danger to man. Domestic animals in the same area may act to some extent as reservoirs of the disease, but their numbers are so small in the fly-areas that little danger is to be anticipated from their presence there.

The species of flies found in Nyasaland are *Glossina morsitans*, *pallidipes*, and *brevipalpis*. *G. palpalis* has not been found.

Dissection of 496 specimens of wild *G. brevipalpis* shewed that 44 contained trypanosomes. Of nineteen of these it was thought that *T. brucei* vel *rhodesiense* was found once, *T. pecorum* nine times, *T. simiae* once, and *T. grayi* eight times. In ten cases the flagellates were thought to belong to a pathogenic species, but to which was not known. No opinion could be expressed in the remaining fifteen cases.

A few experiments were made to test the infectivity of *G. brevipalpis*, and a monkey, a goat, and a dog were infected with *T. pecorum* by that insect.

In Section E of the Report the authors deal with investigations carried out with three strains of *T. gambiense* obtained from Lake Tanganyika. From an examination of the morphology of these parasites the authors conclude that *T. gambiense*, Tanganyika, is very

similar to *T. brucei* vel *rhodesiense*, and that though it would appear to be possible to distinguish them in the blood of rats, owing to the common occurrence there of blunt-ended posterior nuclear forms of the latter species, they cannot be distinguished microscopically in the blood of man.

With regard to the pathogenicity of the two parasites, *T. gambiense* does not so rapidly infect experimental animals as *T. brucei* vel *rhodesiense*, and when the trypanosome has become accustomed to a particular species the disease produced is far more chronic.

In a number of experiments the development of *T. gambiense* in *G. morsitans* was investigated. This parasite did not appear to develop so rapidly as *T. brucei* vel *rhodesiense*, and in positive experiments the period elapsing between the infecting meal and the fly becoming infective was at least 50 days.

In an appendix is given a tabular statement regarding the pupation of *G. morsitans*. From this it may be gathered that the duration of pupation ranged from 30 days in October to 68 days in June.

(218) WATSON (E. A.). **Dourine and the Complement Fixation Test.**—*Parasitology*. 1915. Sept. Vol. 8. No. 2. pp. 156–183.

After a very extensive experience of the method the author has arrived at the conclusion that the complement fixation test is a sure and specific method of diagnosing dourine. The value of the test has been proved not only in cases shewing symptoms of the disease, but also in obscure and latent forms of infection.

The importance of this last point is plain when it is known that infected animals may remain in apparent good health for as long as three years, while capable of transmitting the infection at times during that period.

A brief explanation of the general nature of the reaction is given, and especial emphasis is laid upon the absolute necessity of carrying out quantitative titrations of the various elements used in the test.

Preparation of the reagents.—

Sheep corpuscles are used for the hyperimmunisation of rabbits. The corpuscles from defibrinated blood are washed three times and then mixed with a volume of salt solution equal to their own volume. This 50 per cent. suspension may be stored on ice until required.

Rabbits are hyperimmunised by intraperitoneal injections of the suspension mentioned, starting with 2·5 cc. and increasing to 10 cc., at intervals of 4 to 5 days. Blood may be withdrawn from the heart with a fine needle on a syringe during life. After inactivation it is tested and the haemolytic index should be 0·0005 or higher. From rabbits whose serum gives this index as much as 25 cc. of blood may be drawn from the heart without risk. This is allowed to clot and the serum placed in ampoules in amounts of about 0·2 cc., which are stored on ice. If there is a chance that the serum is not perfectly sterile one-tenth of its volume of a mixture of 95 volumes of glycerin and 5 of phenol may be added.

For obtaining complement it is advised that a guinea-pig should be anaesthetised and suspended over a centrifuge tube of about 30 cc. capacity, the arteries and veins on one side of the neck being severed and the blood collected. The blood is centrifuged before coagulation takes place. Complement must be used fresh.

The antigen is obtained from the blood of infected rats when it is swarming with trypanosomes. A number of rats are inoculated intraperitoneally with blood; and death generally takes place between the third and the fifth day. The obtaining of blood from the rats must be carefully timed, as during the last hours of life the trypanosomes multiply at a great rate and rich antigen is obtainable, but within a few hours the rats may die.

The rats are etherised and the vessels on the left side of the neck are severed with a razor. It is preferable not to sever the trachea. The blood is allowed to run into citrate solution, the volume of which should be equal to or slightly larger than the amount of blood that it is expected will be obtained from the rats. This mixture is filtered through a double layer of sterile gauze and run into centrifuge tubes of 10 cc. capacity and about 10 mm. diameter. Centrifuge for four or five minutes at 1,500 to throw down the corpuscles. Draw off the suspension of trypanosomes and the upper layer of mixed cells and trypanosomes and by the addition of further citrate solution and centrifuging a pure white suspension of trypanosomes may be obtained.

It is stated that ten rats bled at the same time will furnish 5 cc. of trypanosome suspension. This is diluted with twice its volume of preserving fluid containing 90 cc. of salt solution, 10 cc. of glycerin, and 0.1 cc. of formalin. It is then sealed in ampoules containing 1 cc. and stored in ice.

The amount mentioned will provide 100 cc. of antigen which is sufficient for 500 tests. The stock antigen will keep indefinitely if frozen solid, and for 6 to 8 weeks if merely on ice.

To obtain control sera containing antibody a horse is inoculated with *T. equiperdum* and blood is collected at intervals of a week. Serum so obtained may be kept on ice for months or even years. If the serum is not sterile it may be preserved by the addition of 10 per cent. of 5 per cent. carbolised glycerin or iodised glycerin.

In titrating the reagents the following stock mixtures are used:—

Haemolytic serum 1 : 100.

Complement 1 : 20.

Corpuscle suspension 1 : 25.

In titrating the haemolytic serum further dilutions from 1 : 400 to 1 : 5,000 are made, and in a series of tubes 1 cc. of each of these is taken and to each tube are added 1 cc. each of stock complement and corpuscle suspension and 2 cc. of salt solution. This makes the total amount in each tube 5 cc. Controls omitting each element in turn are also used. The tubes are incubated for 2 hours at 37° C.

In this way the least quantity of serum necessary to haemolyse a given quantity of corpuscles, i.e., the titre of the serum, is obtained, and is conveniently expressed by the figure indicating the actual amount of serum present in 1 cc. of the completely effective dilution.

Sera with a value lying between 0.0002 and 0.0005 are satisfactory.

By making a series of tests in which the number of amboceptor units is increased while the amount of complement is diminished it is possible to arrive at a decision as to the number of amboceptor units which work most satisfactorily with the smallest amount of complement. It renders the test the more delicate if the smallest safe amount of complement is used. The reduction in the amount of complement must not be pushed too far as slightly inhibitive properties

of some of the other reagents may obscure the result. Having fixed in this way the number of amboceptor units to be taken as the standard, this is adhered to, and the complement is titrated to that amount. It would appear that two units of amboceptor is the best standard.

In the titration of the complement a series of tubes containing 2 cc. of salt solution, increasing amounts of 1 : 20 complement from 0.3 to 1.0 cc., and 1 cc. of serum is diluted in such a way that the 1 cc. contains 2 units of amboceptor. The tubes are incubated after shaking and the reactions read in an hour. In this way the minimum effective amount of complement is arrived at, and from this it can easily be calculated what dilution of complement must be made so that this minimum amount is present in 1 cc. of dilution.

In titrating the antigen a 5 per cent. dilution of the stock suspension of trypanosomes is made, and also dilutions of haemolytic serum and complement according to the values arrived at.

Sera from a positive and from a negative horse are inactivated for 2 hours at 58° C.

Two sets of tubes are prepared, in the first of which each tube contains 1 cc. of salt solution, 0.1 cc. of positive inactivated serum, antigen in quantities ranging from 0.02 to 0.1 cc. and 0.5 cc. of complement. In the series of tubes for the negative serum double the amount of serum and of antigen is used.

The mixtures are shaken and incubated at 38°–39° C. for one hour and ten minutes, and then each tube has added to it 1 cc. of a mixture in equal parts of haemolytic serum and corpuscle suspension. The tubes are again shaken and incubated for 2 hours. The usual controls are also included.

With the exception of the first tube or two in the positive series all the tubes generally show complete fixation. When the antigen is very strong there may be some inhibition in the negative series in the tubes containing the larger amounts of antigen.

“The amount of antigen to be selected as the titre for the final tests is that which gives complete fixation with the positive serum while double the quantity in the corresponding tube in the negative series does not prevent or inhibit haemolysis.”

While complement in horse's blood rapidly becomes inert even if the serum is not heated, horse, mule, and donkey sera when a day or two old develop enzymotic and proteolytic properties which are anticomplementary, especially in the presence of antigen.

This effect can be eliminated by careful inactivation, but the degree of heating is greater than that required for the destruction of complement. It is advised, therefore, that horse sera should be heated to 59° C. for a full hour in a water bath, and mule and donkey sera at 62° C. for the same length of time. There is little risk of destroying the specific antibodies, as sera can be heated to 65° C., or to the point of coagulation without destroying the specific antibody. All the non-specific factors are eliminated by the degree of heating mentioned.

It is noted that in non-specific inhibition of reactions the red corpuscles are loosely sedimented. In specific complement fixation reactions the red cells are precipitated in a mass or clumps.

Experience has shown that it is never necessary to use more than 0.2 cc. of a suspected serum for a diagnostic test. As even in weak sera such quantity will contain one unit of antibody, while strong

sera may contain 40 units. In animals that have completely recovered and are unable to transmit the disease such a quantity of serum may contain one or more units up to the fifth year after recovery. After that period they may not react, showing not only that recovery is complete but that immunity is also lost. This has been proved by inoculation experiments.

The period elapsing between infection and the first positive result to a complement fixation test may be as short as 11 days in the case of very virulent strains, but in practice a negative result should not be considered as conclusive when the interval between exposure to infection and the test is less than two months.

Details are given of the procedure adopted when only one or a small number of sera are to be tested, and the modifications of this plan that are introduced when large numbers are to be tested daily.

In the former case each serum has four tubes with varying amounts of suspected serum. In the latter case each serum is tested twice: On the first day only one tube is used for each and thus the negative sera can be excluded. These are retested with a single tube on the following day and the positive ones are tested each with four tubes. In all cases the reagents are titrated beforehand, and known positive and negative sera are tested.

In exceptional cases complement fixation is complete with 0.2 cc. of serum, partial with 0.15 cc. and slight with 0.1. This is a positive result and indicates that the serum is weak in antibodies. Generally speaking the results are either clearly positive or clearly negative.

(219) WATSON (E. A.). **The Serum Test for Dourine.**—*Report of the Veterinary Director General, Canada, for the Year ending March 31, 1914.* Appendix No. 19. pp. 111–115.

In November 1913 the most extensive and destructive outbreak of the disease that has so far occurred was discovered in Alberta and Saskatchewan. Up to March 31, 1914, 3,200 complement-fixation tests, 730 agglutination tests, and 85 precipitin tests had been carried out. The number of sera giving positive reactions was 512.

It has been found that positive results can be obtained by serum tests long before any clinical symptoms have made their appearance and in view of the fact that the period of incubation is sometimes very prolonged this is of the greatest value. It appears to be inadvisable to consider any negative reaction as final until three months have elapsed since the last possible date of infection. Among the sera tested a few gave weak or doubtful reactions, but in several cases strong reactions were obtained when the test was repeated after an interval of two months.

It has been found that normal horse serum when fresh and unheated, or after storage for any length of time, is frequently strongly anti-complementary. And it has also been found that heating such serum for half an hour at 58°–59° C. is sufficient to destroy this power while not affecting antibodies in dourine sera. A temperature below 58° C. is not sufficient to destroy the anticomplementary power of the serum and may thus lead to incorrect results. Dourine sera that are weak in antibodies may lose their combining powers if heated to 60° C., although strong sera will withstand heating to 62° C.

When tests are to be made there should be heated along with the suspected sera two sera from normal horses, one of which is anti-complementary, and two sera from animals known to be infected with dourine, one of which is strong in antibody and the other weak.

Antigen is best prepared from the spleen of rats that have succumbed to infection in four days. Strains which require longer periods to prove fatal do not yield such good antigen.

The spleen should be not more than 24 hours old and should be kept on ice until required. The spleen is pulped up in 0.85 per cent. salt solution, and the coarser particles filtered out. One spleen will furnish from 30 to 50 cc. of antigen which generally titres out at 0.15 to 0.30 cc. in the presence of dourine antibody. Two or three spleens should be titred separately at the same time against positive and negative sera, and the emulsion selected should be that which effects complete combination in the smallest dose selected for the test.

The haemolytic system consists of :

Complement : Fresh guinea-pig serum.

Amboceptor : Anti-sheep rabbit serum, titring at 1 : 3,000 or higher.

Four per cent. suspension of sheep's blood corpuscles.

When a large number of sera are tested a double series of tests is carried out on consecutive days. In the first test only one tube is used for each serum and this contains a full dose or slight excess of serum. In this way all negative sera can be eliminated, and thus a saving in material effected. Those giving positive or partial results are retested on the following day with freshly inactivated serum, and where necessary a series of tubes with graduated amounts of serum is used. If questionable results are still obtained with any serum the agglutination test is applied or a fresh sample of serum is obtained for the test after an interval.

(220) HAWKE (W. L.). *An Outbreak of Dourine.—Report of the Veterinary Director General, Canada, for the Year ending March 31, 1914.* Appendix No. 20. pp. 117-118.

In this paper some details are given of an extensive outbreak of dourine which occurred in Saskatchewan.

The mares of a group which had been served by a particular stallion in 1910 were observed to show symptoms during 1911, and subsequently a number of other mares which had been served by the same horse also developed symptoms. It is remarked that special interest attaches to this stallion as it was a pure-bred animal, and as a rule pure-bred horses show less resistance to the disease than others. This animal, however, did not at the time when the mares developed symptoms suspicious of dourine exhibit any evidence of being infected. At a later date, in 1912, severe symptoms developed and the animal was killed. This confirmed the diagnosis, which had been made on the evidence furnished by serological tests and, owing to the absence of symptoms, had been the cause of considerable controversy.

Subsequently a further batch of mares showed evidence of the disease and 67 contact animals were subjected to a test.

Strong evidence was obtained that animals which are apparently in perfect health may be infected and serve as centres of infection.

In no case where the serum test gave a negative result were symptoms ever observed, and animals which were apparently healthy but which gave positive results to the test sooner or later developed symptoms of infection.

The train of symptoms during what is called the "tolerant" stage of the disease was very mild. During the terminal stages there were very marked symptoms, especially of a nervous type.

The latter particularly affected the ears, lips, throat, and larynx. Involvement of the latter caused difficulty in breathing and was responsible for a kind of roaring. Paralysis of the hind quarters was noted but it was not marked. It is interesting to note that no plaques were ever observed.

(221) COLES (A. C.). **Multiplication-forms of *Trypanosoma lewisi* in the Body of the Rat.**—*Parasitology*. 1915. Sept. Vol. 8. No. 2. pp. 184–189. With 2 plates comprising 34 figs.

In this paper the author describes a number of forms that have been seen by him on different occasions spread over a period of years. The material for examination has been dead rats, and many of these have not been examined until some hours after death.

In a small proportion of cases coiled or recurved trypanosomes have been found in smears made from the lungs. They have been found in small numbers only, and always in association with the ordinary form of blood parasite. In some of the ball-like parasites no definite flagellum could be made out, though it was probably present. In a few cases oval bodies with a dense capsule and contents that appeared to suggest coiled up trypanosomes were seen in smears made from the lungs. In another case a small group of small oval bodies somewhat resembling *Leishmania* was found in a lung smear. The author has also found the lung cysts which were stated by CARINI to represent forms of *T. lewisi* undergoing schizogony, and figures of these are given for comparison with the small group of rounded bodies referred to.

In the heart blood and in lung smears respectively from two rats the author has found three large rounded structures measuring about 15 microns in diameter, composed of more or less vacuolated cytoplasm embedded in which were a number of chromatin masses. Each of the larger masses had associated with it a smaller piece, either round or rod-shaped. These forms were met with in the cases in which the coiled parasites were found. Photographs of these forms were submitted to MINCHIN who expressed the view that they certainly represented a stage of development of *T. lewisi*.

As numerous examinations of rats failed to reveal multiplication stages the author turned his attention especially to young naturally infected animals, and in one of these found many phases of multiplication of the parasite: parasites undergoing equal and unequal binary fission, irregular forms with three and even four nuclei, centrosomes, and flagella, and crithidial forms. All of these were found in the blood. No coiled forms or multiplication cysts were found in smears from the lungs of these animals.

In a later note the author states that in three further young rats he has found the parasite in all stages of division in the blood stream. In two of these coiled forms were found in the lungs in small numbers,

and in one specimens were found in preparations from the liver. In fresh preparations the coiled parasites appeared to be enclosed in clear cysts within which they executed twisting movements. The parasites were not observed to escape.

(222) **MAGGIO (C.) & ROSENBUSCH (F.). Studien über die Chagas-krankheit in Argentinien und die Trypanosomen der "Vinchucas" (Wanzen, *Triatoma infestans*, Klug).** [Chagas' Disease in the Argentine and the Trypanosome of the Vinchuca.]—*Centralbl. f. Bakt.* I. Abt. Orig. 1915. Sept. 8. Vol. 77. No. 1. pp. 40-46. With 2 plates comprising 24 figs.

The authors do not appear to have actually detected any case of Chagas' disease in the Argentine, but in the intestinal canal of the common bug (*Triatoma infestans* Klug) they have found large numbers of flagellates similar to those described by CHAGAS.

In moist preparations two forms could be distinguished, a rapidly moving type which was trypanosome-like in form, and a more slowly moving type which was crithidial in morphology. In stained preparations intermediate forms could be detected. The former is said to resemble the trypanosome stage of *Leucocytozoon ziemanni* described by SCHAUDINN.

In freshly caught bugs the crithidial form appeared to predominate, and in bugs kept in the laboratory the trypanosomes tended to disappear.

The bugs in the northern and western parts of the Republic contained numerous flagellates, but those obtained from other parts appeared to be free from them.

Flagellates could not be found in bugs raised in the laboratory. It was found that clean bugs could acquire the infection from infected bugs either by the ingestion of excrement or, as was observed on a number of occasions, by one bug sucking the intestinal contents from another.

Experiments in which infected bugs were fed upon animals, and in which animals were fed with the excrement of infected bugs failed to give positive results. Nor did clean bugs become infected by feeding upon animals upon which infected bugs had previously been fed.

The subcutaneous or intraperitoneal inoculation of mice, rats, and guinea-pigs with the faeces of infected bugs caused infection, the trypanosomes making their appearance in the blood from the 3rd to the 18th day after inoculation. In mice death occurred in from 2 to 4 months. The infection could be transmitted from mouse to mouse, but not to other susceptible animals.

In infected animals cysts like those described by CHAGAS were found. Two types could be distinguished. One type contained parasites closely resembling *Leishmania*, and the other trypanosomes. Certain appearances were observed in preparations which suggested that the trypanosomes escaped from the cysts into the circulation.

In smears from the bone marrow parasites with the characters of *Leptomonas* were found. In blood-broth and on blood-agar positive cultures were obtained from the peripheral blood, heart muscle, striped muscle, and spleen. The parasites of which the colonies were composed were at first leishmania-like, but subsequently they developed flagella and acquired a crithidial form.

- (223) LAVERAN (A.). **Au sujet des Trypanosomiasés équinés du Maroc.** [Equine Trypanosomiasés in Morocco.]—*Bull. Soc. Path. Exot.* 1915. Oct. Vol. 8. No. 8. pp. 576–578.

The author refers to the numerous communications that have been published regarding the occurrence of trypanosomiasis in horses in Morocco, and states that he has received from VIREY some blood smears taken from three horses at Mazis, on the road from Rabat to Fez. In these smears trypanosomes of the *soudanense* type have been found. All the individuals seen possessed a free portion to the flagellum. Those measured ranges from 23 to 30 microns in length and from 1 to 1.5 in breadth.

So far, all that can be said regarding equine trypanosomiasis in Morocco is that there appear to be two types of trypanosomes responsible for the disease: the one obtained from Casablanca which is monomorphic, and that from Mazagan which is polymorphic.

The author advises that cross-immunity tests should be carried out with the object of establishing the identity of these parasites.

- (224) NUTTALL (G. H. F.) & HINDLE (E.). **Experiments in the "Tryposafrol" Treatment of Trypanosomiasis (*T. brucei*) in Guinea-pigs and of Piroplasmosis in Dogs.**—*Parasitology.* 1915. Sept. Vol. 8. No. 2. pp. 218–228.

The authors' conclusions may be summarised as follows:—

All the guinea-pigs infected with the trypanosome died whether they were treated or not, and as the treated ones with one or two exceptions died in shorter periods than those left untreated the drug would appear to have a definitely injurious effect upon guinea-pigs. Both tryposafrol and novo-tryposafrol were used in these experiments with similar results.

Novo-tryposafrol was used for the treatment of four dogs infected with *Piroplasma canis*, the treatment starting on the day of inoculation. All the dogs died, and three of them in a shorter period than the untreated control dog.

LEISHMANIASIS.

- (225) LAVERAN (A.). **Comment le bouton d'Orient se propage-t-il?** [The Transmission of Oriental boil.]—*Ann. Inst. Pasteur.* 1915. Sept. Vol. 29. No. 9. pp. 415–439.

This paper is a survey of the literature regarding various aspects of the transmission of oriental boil.

The first point dealt with is the inoculability of the disease. Then follows a summary of the literature dealing with the fact that the lesions often develop in connection with wounds. The third section of the paper is devoted to a summary of the papers published in connection with the part played by insects, and particularly the domestic fly, in the propagation of the infection. The final section deals with the question of an animal reservoir of the virus.

The following is a summary of the conclusions arrived at:— Oriental boil is transmissible to man and to various animals, and is also auto-inoculable. The lesions frequently develop in connection with wounds, and soiled linen may serve for the transmission of the infection. The fact that the lesions are most usually found on portions of the body that are not protected by clothes appears to indicate that the virus is transmitted by a flying insect. The possibility is suggested that biting insects, although not the direct agents of transmission may nevertheless play an important part in it, in that the irritating nature of the bites inflicted by them may lead to scratching and thus give rise to small wounds through which the virus may gain access. There is some evidence to show that the domestic fly may play a part in the propagation of the disease, as it does in the case of typhoid and other infections. But it appears that it only acts as a mechanical carrier.

There is a possibility that the dog may act as a reservoir for the virus in areas where leishmaniasis of the dog is common, but it is possible that there are several varieties of *L. tropica* and that the mode of transmission differs in different endemic areas. In this way the divergent views of observers working in different countries might be harmonised.

(226) WENYON (C. M.). **Flagellate Forms of *Leishmania donovani* in the Tissues of an experimentally Infected Dog.**—*Jl. Trop. Med. & Hyg.* 1915. Oct 1. Vol. 18. No. 19. pp. 218-219. With 1 text-fig.

This short note records the occurrence in the tissues of a dog inoculated with *L. donovani* of leptomonas forms simultaneously with the ordinary forms.

The dog in question was the fifth in a series, the first of which was inoculated with spleen pulp from a man who contracted the infection in Calcutta. The first inoculation was made in Sept. 1913. The animal from which the flagellate forms were obtained was inoculated intraperitoneally with spleen pulp from the preceding dog in the series, and was killed when on the point of death about five weeks later. The bone marrow showed numerous parasites, some of which were very large, measuring 8 or 9 microns in diameter. Together with these there were a few leptomonas forms, such as are obtained in cultures of the parasite on NNN medium.

The successful transmission of the parasite through five dogs appears to suggest that it can be carried on indefinitely in the dog.

(227) SERGENT (Ed.), SERGENT (Ét.), LEMAIRE (G.) & SENEVET (G.). **Hypothèse sur le phlébotome "transmetteur" et la tarente "réservoir de virus" du bouton d'Orient.** [A Theory regarding Phlebotomus as the Transmitting Agent, and the Tarentola as the Reservoir of the Virus of Oriental Boil.]—*Ann. Inst. Pasteur.* 1915. July. Vol. 29. No. 7. pp. 309-322.

This paper contains a fuller account of the authors' investigations, of which a description has already been published in the *Bulletin de la Société de Pathologie exotique*, and of which an abstract is given in this *Bulletin*, Vol. 2, p. 177. The present publication does not appear to add any information to that previously given.

- (228) SPAGNOLIO (G.). **Die Leishmaniose bei Menschen und Hunden. Studium des Krankheitsgebietes.** [Leishmaniasis in Man and in Dogs. A Study of the Distribution of the Disease.]—*Cent. f. Bakt.* I. Abt. Orig. 1915. Jan. 15. Vol. 75. No. 4. pp. 295-298.

From his clinical observations the author arrives at the conclusion that leishmaniasis occurs more commonly in the open country than in towns and, further, that the evidence does not warrant the view that dogs form the source of infection for children. A small number of cases are mentioned in support of these opinions.

The view is also put forward that the seasonal occurrence of the disease in man contraindicates that the infection is derived from the dog, and consequently that the dog flea does not play a part in its transmission from dog to man.

In the course of his observations the author has in no instance found any evidence of direct transmission of the disease from child to child. In no instance were there two simultaneous cases in children in the same family. It is the adult man that is generally affected, and this contraindicates the flea as the transmitting agent, as the women are far more frequently carriers of fleas than the males.

- (229) MACKIE (F. P.) **The Presence of Leishmania in the Peripheral Blood of Kala-Azar in Assam.**—*Indian Jl. Med. Research.* 1915. July. Vol. 3. No. 1. pp. 90-92. With 1 coloured plate.

The author has found peripheral infections in 21 per cent. of Assamese, and 64 per cent. of Indian coolies. The frequency with which the parasites were found in the blood was practically constant in all stages of the disease. The mononuclear cells were most frequently invaded, and single and multiple invasions were found.

- (230) WENYON (C. M.). **Leishmania Problems: Observations on a Recent Contribution to the Subject.**—*Jl. Trop. Med. & Hyg.* 1915. Nov. 1. Vol. 18. No. 21. pp. 241-247.

This paper is a reply to one by FANTHAM which appeared in the *Annals of Tropical Medicine and Parasitology*, 1915. Vol. 9. No. 2.

PROTOZOA.

- (231) CARINI (A.) & MACIEL (J.). **Ueber *Pneumocystis carinii*.** [*Pneumocystis carinii*.]—*Cent. f. Bakt.* I. Abt. Orig. 1915. Sept. 8. Vol. 77. No. 1. pp. 46-50. With 1 plate in colours comprising 26 figs.

After referring to the views originally expressed regarding the nature or identity of this parasite by a number of observers, all of whom were influenced to some extent by the view expressed by CHAGAS, that they represented a stage of gametogony of a trypanosome, the authors refer to the discovery of parasites having the same morphology in animals that were certainly free from trypanosome infection.

Pneumocystis has up to the present been discovered in guinea-pigs, hares, rats, rabbits, dogs, cats, goats, and sheep. Its occurrence in man is a matter of doubt.

With regard to its occurrence, it is stated that in Brazil ARAGAO found 8 rabbits out of 37 infected, 11 out of 46 guinea-pigs, and 2 out of 7 rats. The lungs appear to be the organs most usually infested. There is however no information as to whether all these species of animals are invaded by the same species of parasite.

In this connection the authors state that, while they have sometimes observed slight differences in different hosts, they do not think that these have any specific importance.

The parasites are not responsible for any marked lesions and, with the exception of one dog which had frequent attacks of coughing, none of the animals under the observation of the authors presented any symptoms indicating infection.

In preparations from the lungs stained with Giemsa the parasites appear as rounded or oval bodies measuring about 5 microns in diameter. There is a delicate capsule, which stains with eosin, enclosing 8 merozoites which have a bright red nucleus and a delicate blue-staining cytoplasm. The authors have never seen the blepharoplast described by CHAGAS. In most cases the merozoites are arranged in a radiating manner, but in some instances they appear to be disposed irregularly within the cyst. It would seem that all the stages of development occur in the lungs, as a number of stages in the process have been observed in preparations made from these organs.

No information is forthcoming as to the manner in which the merozoites make their escape from the cyst. These parasites have never been observed to possess more than one nucleus. After their escape they become rounded and increase in size. They are usually included within cells.

The authors were unable to find the parasite in the bronchial, tracheal, and pharyngeal mucus, and feeding experiments with heavily infested lung tissue failed to give positive results.

(232) DOBELL (C.) & JAMESON (A. P.). **The Chromosome Cycle in Coccidia and Gregarines.**—*Proc. Roy. Soc.* 1915. Aug. 2. Series B. Vol. 89. No. B 610. pp. 83-94. With 2 text-figs.

The authors have studied respectively the chromosome cycles in *Aggregata eberthi*, a coccidium which passes its life cycle in a cuttle-fish and a crab, and *Diplocystis schneideri*, a gregarine of the cockroach.

Aggregata eberthi.—The sexual generation of this parasite is passed in the cuttle-fish and the asexual generation in a crab.

In both the male and the female parasites there are six chromosomes, and in neither does the karyosome play any part in the formation of the chromosomes. Among the chromosomes of the male parasite can be distinguished a very long one and a very short one with four of intermediate sizes. This relationship of size is maintained throughout the mitoses. As in coccidia generally the macrogametocyte becomes a macrogamete without undergoing any process of division.

Before fertilisation the chromosomes break up within the nucleus of the macrogamete, and when fertilisation occurs a complex fertilisation spindle is formed. When the achromatic spindle has been formed for the first division of the zygote nucleus, the chromosomes become associated in homologous pairs, and at the metaphase these temporarily united chromosomes separate without any splitting. As far as

observations have gone the number of chromosomes appears to be constantly six, except just after fertilisation, the reduction occurring at the first division after fertilisation and not during the formation of the sexual forms.

Diplocystis schneideri.—The life history of this parasite is passed in a single host. At an early stage of development the parasites unite in pairs in the gut wall and fall into the body cavity of their host. They increase in size, and by repeated mitoses give rise to a large number of gametes. By the time the process is complete the partition dividing the gamonts has disappeared. When formation of the gametes is complete they fuse in pairs. The nucleus of the zygote gives rise to eight daughter nuclei which become the nuclei of the eight sporozoites developed within each spore. The sporozoites develop into body-cavity parasites in another cockroach.

In the nucleus of the gamont the vesicular karyosome gives rise to three chromosomes. These become constricted and divide, producing one large and two smaller chromosomes at each pole. At the second division they are globular, at the third stumpy, and at subsequent ones filamentar. At the metaphases they split longitudinally.

In the nuclear division of the zygote six chromosomes are formed. The daughter nuclei divide twice, and three chromosomes are visible at each division.

Reduction division therefore occurs immediately after fertilisation.

(233) STEVENSON (A. C.) & WENYON (C. M.). **Note on the Occurrence of *Lankesteria culicis* in West Africa.**—*Jl. Trop. Med. & Hyg.* 1915. Sept. 1. Vol. 18. No. 17. p. 196.

In the course of MacGREGOR's mosquito-breeding experiments, of which an abstract is given in this *Bulletin* (see abstract no. 244), the authors noted that some of the mosquitoes harboured *Lankesteria culicis* Ross 1898. This parasite had previously been recorded as occurring in India, South America, and Bagdad. Interest attaches to the discovery as showing the resistance of the parasite. It must have undergone the same amount of drying as the eggs received in this country, and the infection has passed through several generations of mosquitoes.

(234) de MELLO (F.). **Preliminary Note on a New Haemogregarine found in the Pigeon's Blood.**—*Indian Jl. Med. Research.* 1915. July. Vol. 3. No. 1. pp. 93-94. With 1 plate.

The parasite that is briefly described and figured in this paper, and to which the author gives the name *H. francae*, has the following morphology:—

In the fresh state there can be made out a refractile nucleus situated in the centre of a mass of cytoplasm which has the appearance of a large vacuole. When at rest the parasite is rounded but slight movements within the invaded leucocyte produce changes in shape. The parasites vary in size from 3 to 7 microns in diameter.

In preparations stained with Giemsa the nucleus stains a brilliant red colour, and the cytoplasm faintly blue.

Schizogonous forms are frequently found in the liver, and occasionally in the blood and bone marrow. No such forms have been seen in preparations from the lungs.

In addition to schizogony the author has observed a process of binary division.

The pigeons found to be infected were infested with *Lynchia maura*, and it is suspected that the sporogonous stages of development occur in this insect, though they have not been found.

HELMINTHS.

(235) SWEET (Georgina). **Investigations into the Occurrence of Onchocerciasis in Cattle and Associated Animals in Countries other than Australia.**—54 pp. With 7 plates comprising 12 figs. 1914. Melbourne: Government Printer.

During the course of her tour the author visited Java, the Straits Settlements and Malay Federated States, Ceylon, India, Egypt, Europe, Great Britain, United States of America, Canada, and the Hawaiian Islands. In addition to the personal investigations and inquiries made in these places a certain amount of information was collected as the result of communications addressed to the officials in Burma, Siam, Annam, Southern China, and the Philippines.

The types of bovines considered in connection with the parasite were *Bos taurus*, under which name are included the common tame oxen of Europe and Northern Asia, *Bos indicus*, including the common domesticated humped cattle of India, and *Bos bubalis*, the water buffalo.

In view of the almost certain derivation of the Australian *Onchocerca gibsoni* from cattle imported from India or Malaya, it might have been expected that the parasite found in India would be identical with that occurring in Australia. Careful examination has, however, forced the author to conclude that the two are distinct species, and a new species, *O. indica*, has been made for the Indian parasite.

The full description of the Australian parasite has already been published and it is not repeated here, but a summary is given of the characters of the worm occurring in India.

The male parasite ranges from 3·38 to 9·3 cm. in length and from 0·175–0·220 mm. in diameter in the central portion of the body. The posterior end is often coiled, and the tail is curved ventrally immediately posterior to the cloacal swelling.

In the central portion of the body there are well marked transverse ridges, which are ·005–·006 mm. in width. These gradually become less distinct towards the extremities of the body. The mouth has three lips, and three papillae close behind the level of the opening. The oesophagus is about 1 mm. in length and has a well-defined bulb at its junction with the thin-walled straight intestine. The nerve ring is placed about ·18 mm. from the anterior end, and the excretory pore is about ·07 mm. behind this.

There are generally eight or nine pairs of anal papillae, but these are sometimes asymmetrical.

The spicules are unequal in length, measuring about ·25 and ·08 mm. respectively. The proximal end is funnel-shaped and the distal end pointed or slightly bifid. The short spicule is shoe-shaped at its distal extremity for the guidance of the longer spicule.

The female may be 100 cm. in length. For the greater part of the length the cuticle shows prominent wavy ridges, which may form an almost continuous single or double spiral round the body. No transverse ridges could be detected. The bulb of the oesophagus is generally less distinct than in the male, and no excretory pore could be seen. The vulva is placed on a slight swelling about '6 mm. from the anterior end. This leads into a thick walled vagina which is sometimes twisted.

All stages of development of the eggs were found in the genital tubes up to the free embryo. Imperfect preservation of these prevented exact histological examinations being made.

In the female worm the tail is markedly thinner than in *O. gibsoni*. In the specimens measured the oesophagus was longer.

No information was forthcoming with regard to the life-history of any of the parasites encountered.

The following tabular statement indicates the previous records of the occurrence of parasites belonging to this genus in cattle and associated animals, and the new records of their occurrence:—

Place.	Host animal.	Previous record.	Present record.*
Java	<i>Bos taurus</i> ..	<i>O. gibsoni</i> (De Does, &c.)	<i>O. gibsoni</i> (?)
"	<i>Bos indicus</i> ..	—†	<i>O. sp.</i> (?)
"	Hybrids of above	—	<i>O. gibsoni</i> (?) (subcutaneously)
"	<i>Bos bubalis</i> ..	—	<i>O. sp.</i> (?) (subcutaneously)
"	<i>Bos banteng</i> ..	—	—†
Sumatra	<i>Bos taurus</i> ..	—	<i>O. gibsoni</i> (?)
"	<i>Bos indicus</i> ..	—	<i>O. sp.</i> (?)
"	<i>Bos bubalis</i> ..	—	<i>O. sp.</i> (?) (subcutaneously)
"	<i>Bos banteng</i> ..	—	—
Bali	<i>Bos taurus</i> ..	—	<i>O. gibsoni</i> (?)
Madura	—	—	—
Lombok	—	—	—
Timor	—	—	—
Poeloe Laet ..	<i>Bos indicus</i> ..	—	<i>O. sp.</i> (?)
Philippine Islands	<i>Bos indicus</i> (?)	—	—
"	<i>Bos bubalis</i> ..	—	—
Hawaiian Islands ..	<i>Bos taurus</i> ..	—	—
"	<i>Bos bubalis</i> ..	—	—
Singapore	<i>Bos indicus</i> ..	—	—
"	<i>Bos bubalis</i> ..	—	—
Kuala Lumpur ..	<i>Bos indicus</i> ..	<i>O. gibsoni</i> (Daniels, Ford, Leiper)	<i>O. gibsoni</i>
"	<i>Bos bubalis</i> ..	—	<i>O. sp.</i> (?)
Penang	<i>Bos indicus</i> ..	—	<i>O. gibsoni</i>
"	<i>Bos bubalis</i> ..	—	<i>O. sp.</i> (?)
Malaya	<i>Bos gaurus hub-</i> <i>backi</i>	—	—
Siam	<i>Bos indicus</i> ..	—	<i>O. gibsoni</i>
Burma	<i>Bos indicus</i> ..	—	<i>O. sp.</i> (?)
"	<i>Bos bubalis</i> ..	—	<i>O. sp.</i> (?)

*For Notes see end of Table.

Place.	Host animal.	Previous record.	Present record.*
Assam	—	—	—
Bengal	—	—	—
Bihar and Orissa..	—	—	—
Ceylon	<i>Bos indicus</i> ..	—	<i>O. indica n. sp. (?)</i>
"	<i>Bos bubalis</i> ..	—	<i>O. indica n. sp. (?)</i>
Madras	<i>Bos indicus</i> ..	—	<i>O. indica n. sp.</i>
"	<i>Bos bubalis</i> ..	—	—
Central Provinces and Berar ..	<i>Bos indicus</i> (·5 per cent.)	—†	<i>O. indica n. sp.</i>
Central Provinces and Berar	<i>Bos bubalis</i> ..	—	<i>O. indica n. sp. (?)</i> (subcutaneously)
United Provinces of Agra and Oudh	<i>Bos indicus</i> (2-20 per cent.)	—	<i>O. indica n. sp.</i>
United Provinces of Agra and Oudh	<i>Bos bubalis</i> ..	—	<i>O. indica n. sp.</i> (subcutaneously)
Punjaub	<i>Bos indicus</i> ..	—	<i>O. indica n. sp.</i>
"	<i>Bos bubalis</i> ..	—	<i>O. indica n. sp. (?)</i>
"	<i>Camelus bactrianus</i>	<i>O. fasciata</i> (Leese, Railliet)	—†
Sind, Baluchistan, and Rajputana	<i>Bos indicus</i> ..	—	—
Sind, Baluchistan, and Rajputana	<i>Bos bubalis</i> ..	—	—
Bombay Presidency	<i>Bos indicus</i> ..	—	—
"	<i>Bos bubalis</i> ..	—	—
Egypt	<i>Bos indicus</i> (?) ..	—	<i>O. sp. (?)</i>
"	<i>Bos bubalis</i> ..	—	—
"	<i>Camelus dromedarius</i>	<i>O. fasciata</i> (?) (Mason)	—
Sudan	<i>Bos indicus</i> (?)	—	—
"	<i>Bos bubalis</i> ..	—	—
Algeria and Tunis	<i>Bos taurus</i> (?) ..	<i>O. gutturosa</i> (Neumann)	—
Italy	<i>Bos taurus</i> ..	—	—
Austria	"	—	—
Germany	"	—	—
Denmark	"	—	—
Switzerland ..	"	—	—
France	"	<i>O. bovis</i> (Piettre) not nodule forming	<i>O. bovis</i>
Great Britain ..	"	—	—
United States of America ..	"	<i>O. (?) lienalis</i> (Stiles) in capsule of spleen	—
United States of America ..	<i>Bos indicus</i> and hybrids ..	—	—
South America ..	<i>Bos taurus</i> ..	—	—
"	<i>Bos indicus</i> and hybrids	—	—

*The mark (?) in this column indicates that, although I have now evidence of the existence of the nodules as indicated, either the material available is useless for exact specific determination, or else material for this purpose is not yet in hand.

†The mark — indicates that such nodules are as yet unknown in these cases.

The limitations of the species found appear to be geographical; thus—*O. gutturosa* is characteristic of Northern Africa, *O. indica* is found in India, and *O. gibsoni* in *Bos indicus* in the Malay Archipelago. It is probable that the parasite was introduced into Australia from the last of these areas.

In an addendum it is stated that the author has received nodules from three Indian buffaloes, an animal which at the time of writing the main portion of the report had not been found to be infected.

In some cases there may be no true capsule in these lesions, there being only a small amount of white fibrous tissue forming bundles which emerge from the worm area and mingle with the subcutaneous tissue.

The report contains a full bibliography and a large number of tables giving detailed information regarding the measurements of the parasites.

(236) McEACHRAN (J. F.) & HILL (F.). **Investigations into the Cause of Worm Nodules (*Onchocerca gibsoni*) in Cattle, at Darwin, Northern Territory, Australia.**—8 pp. 1914. Commonwealth of Australia. Melbourne: Government Printer.

In the slaughter house at the Dairy, Darwin, practically every bullock and cow examined showed nodules in the brisket. Insufficient experience prevents the authors from making any definite statement regarding the occurrence of the parasite in the buffalo, but no parasites could be found in six animals examined.

GILRUTH's conclusions regarding the practical absence of reinfection after a certain age, and the tendency for the nodules to become smaller and finally disappear have been confirmed.

The apparent absence of infection in the buffalo suggests that whatever the intermediate host may be, it is one that attacks the ox but not the buffalo.

In order to test the views that have been put forward regarding the occurrence of an intermediate host, five heifers were obtained from Victoria, where the worm rarely occurs in locally bred animals.

No precautions were taken during the voyage and it is probable that the animals were bitten by *Stomoxys calcitrans*, mosquitoes, and perhaps Tabanidae.

On arrival two of the animals were placed in a pen which had been rendered as fly proof as possible, and two others in an open pen adjoining it. The remaining calf was placed with 15 dairy cattle, of which eleven had well developed nodules.

Examination of the calves and of their blood failed to show either nodules or embryos.

A list is given showing the flies, mosquitoes and ticks that have been found on cattle at Darwin, Fannie Bay, and in the vicinity, together with a note as to their seasonal occurrence.

Lyperosia exigua (buffalo fly) greatly outnumbers all the other species and causes the cattle the greatest annoyance.

Stomoxys calcitrans was numerously present, especially near the pens. Whereas *Lyperosia exigua* attacks nearly all parts of the body, *Stomoxys calcitrans* appears to have a preference for the flanks, brisket and legs.

In the first experiment, one of the imported calves was allowed to run with the infected dairy animals, and a locally bred calf served as a control.

The animals were allowed to be in contact for six months.

Three small nodules about the size of peas were found in the brisket of the former animal, and five in the latter. No nodules were found in any other part of the body.

The two calves which were placed in the open pen were observed to be attacked by two species of Tabanidae, by *Stomoxys*, *Lyperosia*, and *Haematopinus tuberculatus*. The infected dairy animals were often in close proximity to the pen but never in actual contact with the calves in it.

When these calves were killed after seven months no evidence of infestation was found in either.

The two calves which were placed in the screened pen were not kept entirely free from insects as it was found that *Culicella vigilax* was capable of passing through the mesh of the wire netting and the calves were observed to be bitten by them.

A few specimens of *Musca domestica* and *Pycnosoma dux* were able to gain access to the pen with the attendant, but they did not remain for more than a day or two.

When the calves were slaughtered at intervals of seven and eight months respectively they were found to be free from infestation.

Experiments with captive Tabanidae were not very successful, as only one species, *T. gregarius* (?), could be got to feed from the summit of a shaved nodule. The other flies used preferred to feed upon the skin surrounding the nodule, even after the hair covering it had grown again. The one fly which fed freely upon the nodule was starved for eight days after it had fed, save for a small meal of honey and water, and it was then carefully examined. The result was quite negative.

Two hundred and thirty-seven flies of different species and lice were examined but in every instance they were quite free from parasites.

Interesting details are given regarding observed facts in the life-history of *Haematopinus tuberculatus* (the buffalo louse). The tail appears to be the only part of the animal invaded. The adults lay the eggs near the tip. The larvae pass up the dorsal surface of the tail until near the root and then pass to the under side where they remain until the nymphs are about half grown. It would appear that at this stage the parasite drops to the ground and completes its development there.

On the swamp buffalo the parasite may be found on practically any part of the body, but the tail, anus, and escutcheon, where the parasites are specially numerous in cattle, are less invaded than other parts.

(237) LANE (C.). A Further Note on Bursate Nematodes from the Indian Elephant.—*Indian Jl. Med. Research*. 1915. July. Vol. 3. No. 1. pp. 105-108.

In this paper the author reconsiders the generic and specific names for nematodes found in the Indian elephant which were put forward in

his previous communication. This revision is necessitated by the prior publication of papers dealing with the same subject by RAILLIET, HENRY, and BAUCHE.

Equinurbia sipunculiformis.—Although termed *Cylicostomum sipunculiforme* by the French authors in their paper, RAILLIET in a private communication expresses his opinion that the parasite should stand as the type of the new genus.

Asifia vasifa.—This name lapses as it was used to designate the parasite named *Choniangium epistomum* by RAILLIET, HENRY and BAUCHE.

Decrusia additicia.—The author maintains that this name should stand, the reasons for the removal of the parasite from the genus *Strongylus* having been given in the previous paper.

Murshidia murshidia and *Murshidia falcifera*.—The author thinks that his genus should stand, as the parasites belonging to it differ from *Cylicostomum*, in which genus the latter parasite is placed by the French observers.

The genus *Quilonia* Lane must apparently be allowed to lapse in favour of *Evansia* Railliet and Henry.

RAILLIET grants the validity of the genus *Amira*.

The author records a case of death in an elephant, which was apparently due to the presence of millions of *Murshidia murshidia* in the small intestine.

(238) LEIPER (R. T.). **Report on the Results of the Bilharzia Mission in Egypt, 1915.**—*Jl. Roy. Army Med. Corps*. 1915. July. Vol. 25. No. 1. pp. 1-55. With 22 text-figs.; Aug. No. 2. pp. 147-191. With 16 text-figs.

Part I. The first twenty pages or so of this report contain a historical survey of the subject. The views that have been expressed regarding methods of infection and the work that has been done in searching for an intermediate host are very fully dealt with. The incidence of the disease is a matter upon which it has until recently been difficult to obtain any exact information, but it appears from figures obtained by MACCALLUM, which the author is able to give, that in different districts the percentage of people having eggs in their urine ranges from about 40 to 70.

The programme of work laid down by the Mission was as follows:—

All fresh-water molluscs that could be found within half a day's journey of Cairo were to be collected and identified. Large numbers of all the species found were to be dissected and examined for trematode larvae. The larvae having morphological characters peculiar to the bilharzia group were to be differentiated from each other. Experiments were to be made to ascertain whether any species of mollusc showed chemiotactic attraction for bilharzia miracidia. Attempts were to be made to infect with cercaria animals brought from England; to ascertain by what path infection took place, and the period of incubation; to study the bionomics of the mollusc and of the cercaria, and particularly the effects of acids and other substances on the latter.

In areas of water in the Zoological and Botanical Gardens at Giza the whole series of molluscs described, with a few special exceptions, was found.

With the object of making a study of the molluscs in the neighbourhood a village, El Marg, was selected as a suitable place, as it was easy of access, without a birket, and was on a small canal coming off almost directly from one of the main supply canals. In its course from the Taufiqia canal to and through the village of El Marg the canal is open to much contamination and an examination of single drops of urine passed by 54 boys, most of whom were under 12 years of age, showed that 49 were infected. The urine was not allowed to sediment nor was it centrifuged. It was therefore determined to make a thorough examination of all the molluscs occurring in this canal.

Owing to the facts that during the summer months the flow of water in the canals is controlled by the Government, allowing 6 days' flow and 15 days' stoppage, and that during the latter periods the canal became dry, the author was able to collect with little chance of missing any all the species of molluscs occurring there.

In examining the species collected two methods were adopted. In the first the molluscs were placed in dishes of clean water for a few days, during which period the cercarial forms were in many cases discharged, and could be seen with a hand lens. In other cases the molluscs were dissected. Those with hard shells were crushed and then torn apart on a slide with a little water or some weak formalin. The soft shelled species could be torn open with needles.

In the course of the investigation seventeen species of trematode larvae were identified, and several new species found.

In addition to the fact that in the adult bilharzia worms the sexes are separate, there is also a complete absence of a definite pharyngeal bulb at the commencement of the oesophagus. "As in all parasitic worms the infective stage shows no sexual differentiation, consequently the absence of the pharynx in the cercaria is the one reliable character upon which a bilharzia cercaria can be distinguished from the cercariae of other distomes, because the body of the cercaria without further metamorphosis grows to become the body of the adult worm."

The cercarial tail is always shed before the parasite gains access to the tissues of the final host. The tail in the four bilharzia cercariae which were found by the authors was forked at its free end, but this character is not distinctive, as it is shared by other forms of distomes.

Most of the species of snails experimented with showed no attraction for the miracidia of bilharzia, but definite attraction was exhibited by *Planorbis boissyi*, *Bullinus* sp. (?), *Pyrgophysa forskali*, and *Limnaea truncatula*. This attraction was stronger in young specimens. It is noted that *Limnaea truncatula* could not be found at Marg.

Molluscs infected with larvae showing the characters of the bilharzia group were found in the canal in or near the village, but the same species of snails found in the agricultural drains at some distance from the village were not infected.

Three cercariae of the bilharzial type were found in four different species of snails. The first showed two black pigment spots just anterior to the ventral sucker, and a well defined cuticular expansion on each side of the two prongs of the bifid tail. This form occurred in *Planorbis mareoticus*, and apparently also in *Melania tuberculata*, and *Planorbis boissyi*. The second form occurred in *P. boissyi* at Marg and other places. A few cercariae apparently identical with this were obtained on one occasion from *Melania tuberculata*. A third species,

which was provisionally distinguished from that occurring in *P. boissyi*, was also found at Marg in a number of specimens of *Bullinus*.

Three species of bilharzia are supposed to occur in Egypt; one of these, of which there are two varieties, is parasitic in man, one in cattle and one in ducks. The facts that have been ascertained appear to indicate that the cercaria with eye spots and bifid tail may be that of the parasite of the duck, as similar cercariae have been found in Central Europe and North America. This parasite is *Bilharziella polonica*.

Attempts were made to infect a calf and a lamb by allowing water containing large numbers of cercariae to remain in the hollows of the groin for from ten to thirty minutes on several days. The results were entirely negative, although it was noted that the skin of the lamb became red where it was repeatedly exposed to infection. Experiments with mice, rats, geese, ducks, chickens, crows, and wagtails gave entirely negative results as far as the birds were concerned. A mouse and a rat were successfully infected. These animals had been brought from London, and had been kept under conditions which absolutely excluded the possibility of natural infection.

It was found that *Schistosoma haematobium* and *S. bovis* were so closely allied that in the experimental mice and rats the difference could be detected with certainty in the adult worms only. In animals which survived seven weeks females were found containing the characteristic eggs, and then the diagnosis was placed beyond doubt.

In addition to white rats and variegated mice, the desert rat and the guinea-pig were found to be susceptible to infection, especially the latter. A Mangabey monkey died in two months from acute infection. No experiments were made with dogs owing to the difficulty presented by the quarantine regulations for the importation of dogs into England.

To ascertain the mode or modes of entry of the parasite into the body an experiment was carried out with four sooty monkeys taken out with the Mission. These were placed in separate cages, and free from all chance of accidental infection. Infested water was placed in the bottom of the cages of three, so as to allow infection through the skin, and the fourth was given heavily infested water to drink. All four died and showed severe infections.

In experimentally infected monkeys, the period of incubation was found to be between one and two months.

Part II. In this portion of the report the author deals with the following points:—Water in relation to the spread of the infection, including methods of irrigation, subsoil water, and rainfall; the prevention of infection in towns and agricultural districts; suggestions for eradication.

He points out that the disease appears to have spread since perennial irrigation was adopted. This is partly accounted for by the increased liability to infection, but more particularly to the more favourable environment created for the intermediate host.

In attempting to control the disease some means must be found to break the life cycle of the parasite. This may be done either by destroying it during the infective stage (free-swimming stage) or by depriving it of its essential intermediate host. The former means appears to be more suitable for application in towns, and the latter in country districts.

In view of the fact that the cercariae do not live in water for more than 36 hours, the danger from unfiltered water would be obviated if it could be stored for a rather longer period than that. Opposition would be raised to this plan, as it would be also to the filtration of all water used in Cairo, because both measures would deprive the water of its manurial value, and the gardens of the town would suffer. Against this is set the fact that under present conditions about 10,000 children become infected annually in Cairo.

The varying condition of the Nile at different periods of the year, and the rate of the flow at different seasons are brought under consideration, and from the information gained deductions are made as to the distance up the river that contamination of the water may occur and still remain viable by the time it reaches Cairo.

In agricultural districts the conditions obtaining in the canals and ditches make these suitable places for the intermediate hosts, and as the people are constantly exposed to infection from this water in the course of their work, preventive measures in such districts should be aimed at the molluscs.

A method of eradication which appears to be applicable to Lower Egypt, save in the rice growing districts, depends upon the "rotation" supply of the water from April to August. During the stoppages of the water for periods of 15 days the canals become dry, except for occasional puddles. Planorbis and Bullinus taken from the dry beds did not revive in water, and of those in the puddles the former appeared to be more hardy than the latter. Had the canals been so constructed that no puddles remained in the dry periods, the intermediate hosts would have been destroyed automatically just at the commencement of the period of their greatest reproductive activity.

The puddles could be treated with some chemical agent suitable for the destruction of the molluscs, but at the same time not injurious to the crops, as the water would be carried on to the land at the commencement of the rotation following. It was found that ammonium sulphate, which is used as a manure, was fatal to the molluscs in a weak solution within a few hours. This, therefore, could be used with safety and without ultimate loss.

The small drains frequently become overgrown with weeds and afford sufficient shelter to the molluscs to enable them to survive for a considerable time. The canals are usually closed for a month during the latter part of December and the early part of January to allow of the removal of silt. If the cleaning could be carried out in the early summer in conjunction with the rotations of water the elimination of the intermediate hosts of the parasite would be assisted.

A consideration of the sowing and harvesting of the various crops grown in Lower Egypt shows that, with the three years' rotation that is generally practised, two-thirds of the land is bare fallow during June and July, and the remainder under cotton.

At the same time the climatic conditions are also the most favourable for a campaign against the carriers of bilharzia. The land in use for cotton could possibly be so arranged that in a given area only one-third was in use. The canals supplying the remaining two-thirds would become quite dry, and the molluscs would be killed off. The screening of those supplies in use would be of further assistance.

The thorough drying of the fallow land during June and July would have the additional advantage of killing off the cotton worm to a very large extent.

The questions arising as to the most suitable places for villages with regard to the canals and drains, and the best methods of draining are dealt with.

The Bionomics of *Bilharzia cercariae*.—

On any surface the cercariae move by alternate use of the ventral and oral suckers. When swimming they move with the tail foremost, periods of rest alternating with periods of swimming. They rapidly attack animals immersed in water, and in one case a young mouse which was placed in infested water for ten minutes contracted the infection.

The cercariae will not live for 48 hours in ordinary tap water, but many survive for 36 hours. Infected molluscs may continue to discharge cercariae into water for periods amounting to weeks. Cercariae cannot withstand the slightest desiccation, and deprivation of oxygen is rapidly fatal. They are immediately killed if the water containing them is raised to 50° C., but they can resist a temperature of 45° C.

Very weak solutions of alkalis stimulate the cercariae, while very weak acids inhabit them. It is seen from a table given that they are readily killed by weak solutions of antiseptics and essential oils.

From the observations made it would appear that infection is by no means limited to the autumn, but may be contracted during the greater part of the year.

Free swimming cercariae are able to pass through a fine silk mesh, stocking material, and in time through several inches of sand if there is a current of water running through it. They are arrested by filter paper.

(239) BOUILLIEZ (M.). *Les bilharzioses dans le Moyen-Chari (Territoire du Tchad). Recherches expérimentales.* [Bilharziasis in the Middle Chari, Chad Territory. Experimental Investigations.]—*Bull. Soc. Path. Exot.* 1915. Oct. Vol. 8. No. 8. pp. 604–610.

There can be little doubt that bilharziosis occurs both in children and in adults throughout the whole Territory. The symptoms are very slight and it is only exceptionally that infected persons present themselves for treatment.

The percentage of children infected with *S. haematobium* was 59, and in one case *S. mansoni* was found.

A number of experiments were carried out in which attempts were made to transmit the infection to animals, but in every case a negative result was obtained. Monkeys, wild cats, and dogs were used and attempts were made to infect them by way of the mucous membranes of the genital organs, through the skin, through skin wounds, and by feeding.

That an intermediate host is necessary does not appear to be very probable, in view of the close relationship that exists between *S. haematobium*, *S. mansoni*, and *S. japonicum*.

Experiments have shown that eggs may contain living embryos after 6 to 8 hours' immersion in 1 in 500 hydrochloric acid, and the authors think that infection may possibly occur by way of the intestinal tract.

Efforts have been made to find a successful method of treatment, but so far satisfactory results have not been obtained. Methylene blue, which appeared to give good results, does not affect the adult parasites. Neosalvarsan and emetine hydrochloride have both failed to yield good results.

(240) WATKINS-PITCHFORD (W.). **Note on Schistosomiasis.**—*Med. Jl. S. Africa.* 1915. July. Vol. 10. No. 12. p. 226.

The author states that CAWSTON (F. G.) has placed *Physopsis africana* obtained from the swimming pool at Pietermaritzburg in water to which a small quantity of urine obtained from bilharzia patients was added. At the end of three weeks cercariae were found encysted in the liver of one of the snails. The appearance of these cercariae and of the sporocysts containing them agreed with the illustrated description given in LEIPER's communication regarding *Schistosoma japonicum*.

(241) CIUREA (J.). **Un Echinostome dans l'Intestin du Porc.** [An Echinostome in the Intestine of the Pig.]—*Cent. f. Bakt.* I. Abt. Orig. Vol. 75. No. 5/6. Feb. 15. 1915. pp. 392-394. With 1 text-fig.

The author states that he has found in the intestine of a young pig, which had been fed for two months upon fish, four adult echinostomes which he considers to be identical with *Echinochasmus perfoliatus*, described as occurring in the dog and the cat.

The following are the principal features of the parasite :—

The body, which is elongated tapering slightly towards each end, is more or less flattened, especially in the anterior part. The length varies from about 2 to 3.25 mm. and the breadth from 0.4 to 0.75 mm. The anterior extremity shows an adoral disc from 0.2 to 0.3 mm. in diameter, which has a gap in it on the ventral side. Laterally each half of this disc shows 12 small rod-like structures. These measure from 0.037 to 0.044 mm. in length and 0.013 in thickness at their bases.

The surface of the body is covered with scales which are triangular in shape with the apex directed backwards. These scales disappear at about the level of the posterior testicle.

The buccal sucker measures from 0.09 to 0.13 mm. in diameter and the ventral sucker is nearly twice that size.

The genital pore opens immediately in front of the ventral sucker. The testicles are placed one in front of the other near the middle of the body, and are more or less oval in shape.

The globular ovary is situated above and to the right of the anterior testicle, and below and to the left of this is the shell gland. The vitelline glands occupy the whole of the posterior portion of the body and extend up on either side to the level of the ventral sucker.

The uterus contains only a few eggs, which measure 0.092 to 0.11 mm. in length and 0.05 to 0.07 mm. in width.

- (242) SKRJABIN (K. J.). **Beitrag zur Kenntnis einiger Vogelcestoden** [Description of Certain Cestodes of Birds.]—*Cent. f. Bakt.* I. Abt. Orig. 1914. Aug. 29. Vol. 75. No. 5/6. pp. 59–83. With 42 text-figs.

In this paper the author describes a number of cestodes obtained from the Museum of Natural History, Berlin, and from the Göteborg Museum.

The following is a list of the parasites dealt with:—

- A. Anoplocephalidae :
1. *Aporina fuhrmanni* n. sp.
 2. *Cittotaenia columbae* n. sp.
- B. Davaineidae :
3. *Davainea laticanalisis* n. sp.
 4. „ *cyrtus* n. sp.
 5. „ *emperus* n. sp.
 6. „ *galeritae* n. sp.
 7. „ *paradisea* Fuhrmann.
 8. *Chapmania unilateralis* n. sp.
- C. Dilepinidae :
9. *Uncinaria trichocirrosa* n. gen. n. sp.
 10. *Anomotaenia socialis* Krabbe.
- D. Hymenolipidae :
11. *Hymenolepis flaminginis* n. sp.
- E. Acoleidae :
12. *Progynotaenia fuhrmanni* n. sp.
 13. *Gyrocoelia brevis* Fuhrm.

- (243) GAIGER (S. H.). **Treatment of Nematode Diseases.**—*Vet. Record.* 1915. Sept. 18. No. 1419. pp. 128–130.

This article contains some criticisms of a paper by CRAIG presented at the Tenth International Veterinary Congress, London, 1914, and read before the National Veterinary Association of Ireland, May 20th 1915.

BITING FLIES.

- (244) MACGREGOR (M. E.). **Notes on the Rearing of *Stegomyia fasciata* in London.**—*Jl. Trop. Med. & Hyg.* 1915. Sept. 1. Vol. 18. No. 17. pp. 193–196.

The eggs from which the mosquitoes were obtained were sent from West Africa on some leaves of the West African cotton-wood tree. The leaves with the eggs attached to them had been at least three and a half months in a dried state. The majority of the eggs looked very shrivelled but some appeared to be normal.

The leaves were placed in tap water and left at room temperature. Within 24 hours the water was crowded with larvae. The number present indicated that some at least of the shrivelled eggs must have been viable.

By comparative tests it appeared that larvae kept in water at about 26° C., in which straw from horse manure had been placed as food, were the largest, and they also completed their metamorphoses most quickly. Those in water about 7° C. lower in temperature were nearly as good specimens, but they were three days longer in completing their development.

At the temperatures mentioned the average larval period was ten days, and the pupal period six days.

The males and females as they emerged were placed in small cages and were observed to copulate almost immediately.

It was found that they would feed upon a black guinea-pig but not upon a white one, and that they fed much more voraciously after their first meal of blood.

The males were observed to live from ten days to three weeks, and the females from a month to six weeks or even longer.

The females engorge themselves with blood in about five minutes, and apparently eggs require from three to five days after a meal to become mature. The eggs are deposited on the surface of water or attached to leaves in it. If the eggs are caused to sink by agitation of the water the majority of them do not hatch. Some of the females laid as many as eight batches of eggs.

The males do not suck blood as do the females, but they seem to take in minute quantities of sweat from the skin of a guinea-pig placed in the cage with them. Males will not approach a resting female, but if the females are disturbed the males at once approach them.

Pupation can be observed by placing the vessels containing the larvae in a fairly dark place. When pupation occurs the skin splits dorsally and the pupa emerges. The process is sometimes complete in 30 secs., but it generally takes longer.

When first hatched the larvae measure about 1 mm. long by 0.3 mm. at the greatest breadth, but after a few hours at 25° C. they are very much larger, and the head has enlarged and become dark in colour. When about to pupate they become opaque and of a yellowish colour.

The eggs are laid from three to five days after the female has fed, and at 30° C. they hatch out in about the same period, but in some cases the hatching is spread over a period of a week or more.

Attention is drawn to the possibilities opened up of *S. fasciata* being distributed very widely, either by leaves carried by the wind, or in bales of raw materials. The mosquito is so hardy that it might easily establish itself in countries where it is not at present known, and there have access to the virus of yellow fever.

The mosquitoes bred by the author have reached their sixth generation.

(245) BEQUAERT (J.). **Note rectificative concernant les Auchméromyies du Congo.** [A Correction regarding the Auchmeromyia of the Congo.]—*Bull. Soc. Path. Exot.* 1915. Oct. Vol. 8. No. 8. pp. 593-594.

In the July number of the *Bulletin de la Société de Pathologie Exotique* the author recorded the capture of *Auchmeromyia* (*Chaeromyia*) *chaerophaga* Roub. in the Congo. Examination of the insect has shown that it is in reality *Cordylobia anthropophaga*.

EPIZOOTIC LYMPHANGITIS AND SPOROTRICHOSIS.

- (246) MEYER (K. F.). **Epizootic Lymphangitis and Sporotrichosis.** (Studies on American Sporotrichosis II.)—*Amer. Jl. Trop. Dis. & Prevent. Med.* 1915. Sept. Vol. 3. No. 3. pp. 144–163.

After dealing at some length with the controversy regarding the nature of the parasite that is responsible for epizootic lymphangitis and its staining reactions, the author states that he has been able to confirm the results published by BRIDRÉ and NÈGRE in 1910 showing that the complement fixation test can be applied to the diagnosis of the epizootic lymphangitis.

Two experiments of this nature were carried out before the author left South Africa. As antigen the suspected parasites were used. These were separated from pus by antiformin and suspended in carbolised salt solution. In a tabular statement the quantities of the various elements used in the tests are given.

Both sera gave positive results with the cryptococcus and negative results with *B. mallei*, *B. nephritidis equi*, and *B. pseudotuberculosis rodentium*.

Further tests were carried out with two sera received from Jamaica in 1912, one from a horse and one from a mule. These gave positive results with the cryptococcus. It is said that fixation was also obtained with suspension of "*Blastomyces equi*, *B. bovis*, blastomycotic sporothrix, and baker's yeast." Negative results were obtained when various bacilli were used as antigen. Uniform results could not be obtained when the sera were tested with *Sp. schencki-beurmanni*.

From a tabular statement given it would appear that exactly parallel results were obtained with the organisms mentioned above when they were used as antigen for sera derived from a case of epizootic lymphangitis and from a case of sporotrichosis in the human subject.

It is also stated that in one experiment epizootic lymphangitis serum gave complete haemolysis when a saline suspension of *T. equiperdum* was used.

Sporotrichosis is thought to have been introduced into the United States from Cuba at the time of the Spanish American war, but no careful study of the disease was made until 1910. It is pointed out that sporotrichosis differs from epizootic lymphangitis in the following respects :

It is not confined to tropical and subtropical zones, whereas epizootic lymphangitis is, except when it is accidentally introduced into a temperate climate. It has no seasonal distribution. It is not contagious; cases of sporotrichosis are always sporadic. It is rarely fatal. The parasite is very scantily present in the pus, and a definite diagnosis cannot be based upon microscopic examination. Such organisms as are present are in the form of short mycelia and not spores. They vary in length from 2 to 10 microns and in breadth from 1 to 3 microns. The membrane is thinner than in the case of the cryptococcus, but it is resistant to caustic potash and acetic acid.

It is said that budding forms have never been observed. The organism is more Gram-fast than the cryptococcus, but with Giemsa the appearances presented by the two organisms are very similar.

The reddish material present is thought to be metachromatic and not nuclear in nature. With iron haematoxylin a very small granule could always be detected in the centre of the metachromatic material. In sections, and especially those from old lesions, the organisms tend to lose their power of retaining Gram's stain. The author cannot confirm PAIGE and FROTHINGHAM's statement that the organisms are more numerous in ruptured lesions.

The sporothrix is easily cultivated, and this is the best method of arriving at a diagnosis.

The administration of iodine intravenously, it is not stated in what form and in what dose, effects a rapid cure of sporotrichosis, and the administration of the same drug per os also gives good results.

The disease is rarely transmitted from animals to man.

RABIES.

(247) AMATO (A.). *Ueber die Speicheldrüsen bei Lyssa.* [The Salivary Glands in Rabies.]—*Cent. f. Bakt.* 1. Abt. Orig. 1915. July 22. Vol. 76. No. 6. pp. 403-409. With 1 plate in colours comprising 13 figures.

The investigations recorded in this paper have been carried out on the parotid and submaxillary glands of rabbits infected with the fixed virus.

The parotid gland.—There appears to be an increase in the amount of connective tissue present in the gland, but in reality this increase is due to an oedematous infiltration of the tissue. It is only here and there that there is any cellular infiltration. The epithelium lining the ducts is generally normal, but in some cases it appears to have been shed into the lumen of the tubes. The cells not infrequently have a vacuolated appearance, but the author has never been able to demonstrate any fat in them. In one case the author observed a complete structural alteration in one lobule of the gland. This lobule had the appearance of a large space divided up into a number of cavities by septa of fibrous tissue, the cavities being filled with enormous numbers of mononuclear leucocytes, intermixed with phagocytes and red blood corpuscles. Among these could be made out rather indistinctly a number of the parenchyma cells. The outlines of the cells were vague and their nuclei were vesicular.

The alterations present in the submaxillary gland were like those present in the parotid, but they were generally rather more marked.

In both glands the author has observed in the epithelium lining the acini and in that shed into the lumen of the ducts, and also in some cases free in the ducts, rounded, oval, or irregularly three-sided bodies of which he gives a detailed description. Some of these bodies showed one or more vacuoles in their substance, while others appeared to contain a variable number of granules of different sizes arranged in various ways.

In the author's opinion the secreting epithelium becomes increasingly granular until the cells are packed with granules. Then vacuoles make their appearance, and these undergo a marked increase in size, thus producing the vacuolated appearance of the cells already referred to.

The rounded or oval bodies seen by the author stained red with Mann's stain, and were of a deeper tint than the surrounding cytoplasm. These bodies bore a marked resemblance to Negri bodies.

The structures which showed no bodies included within them are, in the author's view, evidence of a kind of condensation of protoplasm. He believes that the cellular inclusions observed represent some degenerative or secretory change.

The author ventures to doubt the parasitic nature of the structures resembling Negri bodies recently described by a number of authors as occurring in the salivary glands.

- (248) FERMI (C.). **Pouvoir immunisant de la substance nerveuse rabique d'animaux (poulets, canards, oies) dont la substance nerveuse normale est privée du pouvoir immunisant. Mécanisme de l'immunisation rabique. III. Note.** [The Immunising Power of the Rabic Nervous Tissues of Animals (Fowls, Ducks, Geese), the Normal Nervous Tissue of which is Devoid of Immunising Power.]—*Cent. f. Bakt.* I. Abt. Orig. 1915. July 22. Vol. 76. No. 6. pp. 434-436.

Having shown that a mixture of rabic virus and rabic nervous tissue is not always capable of producing immunity because (1) either the grey matter or the white matter alone possesses practically no immunising power as compared with that possessed by the two substances together, and (2) because the vagus and sympathetic and ischiatic nerves are practically devoid of any immunising properties, the author investigated the immunising properties of the rabic central nervous system of animals the normal nervous tissue of which is devoid of any immunising properties. For this purpose he selected the fowl, duck, and goose and tested their power of immunising mice and rats.

Details of the experiments are given in tabular form and the conclusions drawn are as follows:—

1. Rabic nervous tissue of the chicken and the goose when made into a five per cent. emulsion in 1 per cent. phenol is practically inactive. Only 20 per cent. of the mice appeared to be protected by the former and 29 per cent. of the rats injected were protected by the latter. The animals received two daily injections subcutaneously of 1 cc. and 0.25 cc. respectively for fifteen days.

2. Rabic nervous tissue derived from a duck failed to protect any of the 8 mice used in the experiment.

- (249) FERMI (C.). **Pouvoir immunisant et lyssicide des nucléo-protéides des substances nerveuses et normales, des substances blanches et grises séparées, de la substance testiculaire, du jaune d'œuf et des testicules du mouton. Mécanisme de l'immunisation rabique. IV. Note.** [The Immunising and Anti-rabic Properties of the Nucleo-proteid Substances of Normal Nervous Tissue, the White and Grey Matters separately, Testicular Substance, Egg Yolk, and Sheep's Testicles.]—*Cent. f. Bakt.* 1915. July 22. Vol. 76. No. 6. pp. 436-441.

The author's conclusions drawn from the experiments, the details of which are given in tabular statements, are as follows.

1. The nucleo-proteids obtained from the brain tissue of a normal sheep in a first experiment was shown to possess anti-rabic properties to the extent of rendering 1 cc. of a 1 per cent. emulsion of fixed virus inactive in a dose of 0.2 cc. when injected subcutaneously.

In a second experiment it was found to be active, but incompletely in a 5 per cent. dose.

2. Nucleo-proteids obtained from the white and grey matters separately either from the sheep or the ox were found to be entirely devoid of any anti-rabic properties, because a mixture of equal parts of these failed to neutralise a 1 per cent. emulsion of fixed virus.

3. The nucleo-proteids of egg yolk and sheeps' testicles were found to be similarly devoid of any protective power.

(250) FERMI (C.). **La virulence, respectivement la dose minima mortelle de la salive et des glandes salivaires rabiques comparée à celle de la substance nerveuse rabique. Contribution au mécanisme de l'immunisation rabique.** [The Relative Virulence of the Saliva, the Salivary Glands, and the Nervous Tissue in Rabies.]—*Cent. f. Bakt.* I. Abt. Orig. 1915. May 20. Vol. 76. No. 2/3. pp. 178-183.

In testing the virulence of the saliva of dogs affected with street rabies, dilutions ranging from 1 in 1,000 to 1 in 50,000 were used, and of these dilutions 0.25 cc. was used for the inoculation of mice, either subcutaneously or into the eye. In the first experiment no dilutions between 1 in 1,000 and 1 in 10,000 were made, and only the mouse receiving the former succumbed. In later experiments the dilutions producing a fatal result ranged up to 1 in 6,000.

Working on similar lines with a 1 per cent. emulsion of submaxillary gland, from a dog dead of street rabies, made up with 5 per cent. carbolic acid, a similar result was obtained. In view of the fact that the amount of solids present in the salivary glands is thirty-six times as great as that present in the saliva, the latter is far more virulent than the former (36 times).

The minimal lethal dose of nervous tissue both of fixed virus and of street virus in the dose mentioned was in dilutions of 1 in 50,000 to 1 in 70,000. As the total solids in the nerve tissue are about equal to those in the salivary glands it follows that the nerve tissue is ten times as virulent as the gland tissue.

Calculating in the same way the author arrives at the conclusion that the saliva is 24 times as virulent as the nerve tissue.

(251) FERMI (C.). **Pouvoir immunisant de la salive et des glandes salivaires rabiques, c'est-à-dire, du virus isolé de la substance nerveuse.** [The Immunising Properties of the Saliva and Salivary Glands of Rabid Animals.]—*Cent. f. Bakt.* I. Abt. Orig. 1915. July 10. Vol. 76. No. 5. pp. 349-356.

The author finds that repeated injections of saliva from dogs infected with street virus containing 1 per cent. carbolic acid, are without effect for the protection of animals previously inoculated subcutaneously with street rabies. The same negative results followed the use of a five per cent. emulsion of salivary glands in salt solution containing 1 per cent. carbolic acid.

MISCELLANEOUS.

- (252) MARTOGLIO (F.). **Sulla tecnica per la produzione del siero contro la peste bovina. Utilizzazione del liquido di lavaggio vasale come antigene.** [The Technique of the Production of Rinderpest Serum. Utilisation as Antigen of the Liquid obtained by washing out the Blood Vessels.]—*Memorie dell' Instituto Siero-Vaccinogeno Eritreo, Asmara.* 1915. July 15. No. 1. pp. 1-24.

The author refers at some length to the various methods that have been tried at different times with the object of increasing the amount of antigen obtainable from infected animals. He found that the serum obtained by the method described by HOLMES of using peritoneal washings as antigen was not so satisfactory as that obtained when blood was used. He therefore devised a means by which a considerable quantity of the blood ordinarily remaining in the vessels when an animal is bled to death could be made available for use as antigen. This method involved the partial bleeding of the animal, followed by an intravenous injection of salt solution, the animal being subsequently bled to death.

The following are the details of the method :—

On the fourth or fifth day, when lesions of the buccal mucous membrane have developed, the jugular vein is placed in connection with a vessel containing salt solution, the tube being closed by a pinch-cock, and the carotid is placed in connection with a vessel for the reception of blood. When the pre-agonal symptoms begin to make their appearance the bleeding from the carotid is stopped and salt solution is allowed to flow into the jugular. The symptoms gradually abate, and by the time an amount of salt solution equal to the amount of blood withdrawn has been allowed to pass into the jugular the animal is quite calm again.

The introduction of salt solution is not stopped at this point, as if that is done the amount of blood obtained at the second bleeding is small. The author's practice is to introduce about two and a half times the volume of the blood withdrawn. The injection of the salt solution must be stopped immediately symptoms indicative of a rapid rise of intravascular pressure are observed.

After an interval of five to six hours the animal is bled to death.

The liquid obtained at the second bleeding has exactly the appearance of blood, but of course it differs from blood in several physical characters.

Eighty-five calves yielded from 3·4 to 4·6 litres of blood at the first bleeding, and from 3·5 to 5·5 at the second bleeding.

Parallel experiments, in which animals were hyperimmunised with pure blood and with washings from the vessels, showed that the sera obtained from the two batches were identical in respect of their protective properties.

The conclusions drawn are as follows :—

In the production of anti-rinderpest serum it is desirable to increase the quantity of virus available in order to have a larger amount of antigen for the production of the serum, and thus lessen the expense of obtaining susceptible animals.

The method of diluting the virus suggested by HOLMES and BALDREY does not appear to be justified, inasmuch as the serum produced by the diluted virus is less active than that produced by the pure virus.

The method of washing out the peritoneum first suggested by NICOLLE and ADIL Bey yielded, after the liquid used had been modified, better results. But the fact remains that the serum produced in this way was always rather less active than that produced by pure blood, and the technique is likely to lead to accidents.

The use of the liquid obtained by washing out the blood vessels is quite satisfactory, because (a) the yield of virus is increased by 70 per cent., (b) by its use as antigen a serum equal in activity to that produced by pure blood was obtained, and (c) the technique of the method is easy and absolute asepsis is maintained.

(253). THEILER (A.). **Historical Sketch of the Investigations into Lamziekte.**—*Report of Dept. of Agric. Union of S. Africa.* 1913–1914. pp. 123–129.

HUTCHEON's inquiries into the nature of this disease in 1895 led him to form the opinion that it was due in some way to a deficiency of phosphates in the diet. An experiment designed to test this view certainly gave it considerable support.

A further carefully controlled series of experiments carried out in 1907 lent additional support to this view. In both these sets of experiments the administration of bone meal appeared to have a remarkable effect in preventing the disease.

Two years later another experiment on the same lines also furnished confirmatory evidence that the view put forward was correct, but in this case so much reliance could not be placed upon the experimental results, as it was shown that some of the animals died from a disease other than lamziekte, namely heart water.

Between 1904 and 1910 three or four reports were published regarding the pathology of the disease, in which support was given to the view that the cause of the condition was an organism of the fowl cholera type.

An experiment carried out in 1908 by the Government Veterinary Bacteriologist for the Transvaal yielded negative results, as none of the animals died, but during the course of these experiments the fact was established that stijfziekte and lamziekte, regarding the identity of which there had been some doubt, were in reality two different conditions and, further, that the former of these was due to the cattle eating *Crotalaria burkeana*.

In 1909 a further series of experiments was carried out, but again the results were inconclusive as only one control animal died.

Experiments were again undertaken in 1911. Fifty animals were allowed to graze night and day upon the veldt, and fifty others were herded with them, but these were muzzled during the day and fed in a kraal at night with forage from a clean area. Of those at liberty on the veldt 28 per cent. became affected and only four animals recovered.

All attempts to transmit the disease with materials derived from dead animals failed.

No cases of lamziekte were produced in experiments in which animals were fed with 57 species of plants.

Grass cut from the land where the grazing cattle had contracted the disease failed to produce any cases when fed to cattle in clean areas. It was further found that the disease tends to disappear when an infected area has been well grazed down.

Experiments to test the view that the disease might be due to lack of vitamins failed to produce any evidence to this effect.

It was found that a certain degree of immunity was established by the inoculation of susceptible animals with blood derived from cases of the disease and also with cultures of the organism of the fowl cholera type which had been blamed as the cause of the disease. This immunity, however, did not appear to be specific.

The general conclusions arrived at are as follows :—

The disease is primarily one of the muscular system, the nervous system being involved secondarily. The toxin which is responsible for the disease of the muscular system is not necessarily cumulative in action, as cases may occur in as short a period as fifteen days after exposure. The toxin is in some way connected with the feeding of grass, but whether the grass as such or something taken in with the grass is responsible cannot yet be determined. The failure to set up the disease with grass or hay from a lamziekte area tends to support the latter view. The fact that in one of the experiments in which the animals were muzzled two contracted the disease ten and twelve days after they had ceased grazing may possibly indicate a period of incubation.

(254) WATSON (E. A.). **Swamp Fever Research.**—*Report of the Veterinary Director General, Canada, for the Year ending March 31, 1914.* Appendix No. 19, p. 116.

Owing to pressure of work in carrying out diagnoses of dourine the investigation of swamp fever has not been prosecuted as fully as it might otherwise have been. It has, however, been found that infected animals may appear to be in perfect health, and that horses which have survived may carry the infection for periods of a year or even more.

Animals other than the horse appear to show no evidence of infection when inoculated with virulent materials.

There is a prospect that it may be possible to devise a method of diagnosis based upon the precipitin reaction.

(255) WYSSMANN (E.). **Zur perniziösen Anämie der Pferde.** [Pernicious Anaemia in the Horse.]—*Schweiz. Archiv. f. Tierheilk.* 1915. Sept. Vol. 57. No. 9. pp. 427–449.

In the introductory portion of this paper the author summarises the literature regarding pernicious equine anaemia, and draws attention to the theory of causation published by the SEYDERHELMS in the *Berliner Tierärztliche Wochenschrift* for 1914, that the condition is due to a toxin elaborated by *Gastrophilus equi* and *Oestrus haemorrhoidalis*.

Wyssmann has seen 125 cases of anaemia in horses, of which 44 were of a pernicious character. In the remaining cases the anaemia was a secondary condition.

Although the author has seen cases of the disease in good stables, the majority occurred in dark, damp stables.

In fifty per cent. of cases the animals were under seven years old.

The majority of cases occurred during the months March, May, August, September, October, and November.

In most cases the onset of the disease is sudden, with an elevation of temperature. There is marked depression and the animals have a sleepy appearance. The visible mucous membranes have a pale red tint which is sometimes slightly yellowish.

The pulse is weak and accelerated, ranging from 50 to 90 per minute, and this is associated with rapid breathing and complete loss of appetite.

In cases of longer standing there is oedema of dependent parts, the mucous membranes are pale or even yellow. In the majority of the acute cases observed by the author the animals affected were in good condition at the time when the disease made its appearance.

In acute cases the haemoglobin content of the blood is between 30 and 50 per cent., and in cases that are of longer standing it may be as low as 15 per cent. The yellow opalescent appearance of the blood serum is particularly striking.

Although the author does not appear to have made any blood counts, he judges by examining blood in a test tube that there was no decrease in the number of red corpuscles in acute cases.

The lesions are in general of a dropsical type. The liver is enlarged and firmer in consistence than normal, as a result of degeneration of the parenchyma. The spleen is generally enlarged and the surface may show a number of haemorrhages as large as nuts. The kidneys are enlarged and pale in colour. The serous membrane of the large intestine frequently shows ecchymoses, and the haemorrhagic swelling of the lymphatic glands is very pronounced.

In the author's opinion the prognosis is not so unfavourable as many observers think. Of his 44 cases, 25 died, 5 improved, 11 were cured, and of three he lost sight. He thinks there is a chance of improvement while the haemoglobin content does not fall below 40 to 55 per cent.

In a tabular statement the author gives the records of the 44 acute cases, showing the range of temperature, pulse, respirations, symptoms, percentage haemoglobin-content of the blood, ratio of red blood corpuscles to the plasma, duration of the treatment, and the result.

He recommends the subcutaneous injection of a ten per cent. watery solution of atoxyl, but in advanced cases accompanied by oedema this drug does not give good results. In acute cases at least one dose should be given a week, and the quantity should be from 10 to 20 cc.

(256) BURGESS (E.). **Disease in Swine.**—*MS. Report by the Acting Director, Bacteriological Institute, Colombo, to the Senior Sanitary Officer.* 4 pp. f'cap. Dated April 5th 1915.

This report contains a brief description of an organism isolated from the organs of two dead pigs and one killed for the purpose of the examination. No information is given regarding the nature of the disease in the pigs.

No organisms of the haemorrhagic septicaemia type nor *B. suisepiticus* could be detected in any of the viscera.

The organism isolated was a non-motile, Gram negative diplo-bacillus (or possibly a diplococcus) measuring about 0·5 microns by 0·4. On agar, gelatin, and serum a thin whitish or transparent growth was developed. There was no liquefaction of the latter two media. In broth a slight turbidity was produced, but there was no pellicle formation. There was a slight formation of indol, and possibly some reduction of nitrates. Neutral red was not reduced.

In media containing saccharose, mannite, glucose, maltose, dextrin, sorbite, galactose, laevulose, and glycerin a slight degree of acidity was produced, but there was no gas formation.

No change was produced in lactose, dulcitol, raffinose, arabinose, adonit, inulin, inosit, salicin, amygdalin, isodulcitol, erythrite, or litmus milk.

The organism was obtained in pure culture or almost pure culture from the spleen of each of the pigs and in one of them also from the liver, lungs, and a gland.

Guinea-pigs inoculated intraperitoneally with 18- or 24-hour broth cultures generally died within 24 hours. The organism was recovered from some of these and used for the inoculation of a further series, in which the same results were obtained.

The post-mortem appearances presented by the guinea-pigs were :

Marked subcutaneous congestion, the tissues having a purplish-pink colour. Congestion of the peritoneum and small intestine. Very marked congestion of the inguinal glands. Excessive quantity of fluid in the peritoneal cavity. Liver, lungs, kidneys and spleen apparently normal.

The symptoms prior to death were : The animals were very weak and only able to move with difficulty, and just before death they lay quite motionless. There was no diarrhoea.

The symptoms and lesions observed in naturally infected pigs are stated in a marginal note to be practically identical with those observed in the experimentally infected guinea-pigs.

Blood from the live pig, and from two of the infected guinea-pigs failed to give positive results when the agglutinating power of the serum was tested with the organism.

(257) COCA (A. F.). **A Rapid and Efficient Method of producing Haemolytic Amboceptor against Sheep Corpuscles.**—*Jl. Infect. Dis.* 1915. Sept. Vol. 17. No. 2. pp. 361-368.

The author states that the usual method of producing haemolytic serum, by giving a series of injections at intervals ranging from a few days to a week, frequently fails to produce a serum which is both of high haemolytic strength and good in its lasting qualities. He finds that intravenous injections of small quantities of corpuscles at short intervals produce highly haemolytic sera which retain their power with great constancy. The most powerful sera obtained were yielded by animals (rabbits) which had daily intravenous injections of washed sheep corpuscles of 0·1 cc. for many weeks.

Comparative experiments carried out with rabbits indicated that stability of haemolytic strength was obtained better when the animals received only a few injections than when many were given. It was found that two injections of 1 cc. of corpuscles at an interval of five

days produced sera of a power equal to those obtained when the dose of corpuscles was 2 cc. with second injections of 5 or 10 cc.

In comparative tests the evidence obtained indicated that the optimal time for giving the second injection is not earlier than the fourth day after the first. The maximum content of haemolysin is reached after a first injection in about seven days, and it is not more than five days after the second.

Sera prepared in the manner described and preserved on ice after the addition of 0.25 per cent. of carbolic acid retain the same degree of haemolytic power for two months.

(258) COOPER (W. F.) & LAWS (H. E.). **Some Observations on the Theory and Practice of Dipping.**—*Parasitology*. 1915. Sept. Vol. 8. No. 2. pp. 190–217. With 1 plate & 2 text-figs.

In the introductory portion of this paper a brief general survey of the subject of dipping, and a description of the tank and its method of use are given.

It is pointed out that the concentration of the dip should be varied according to the interval between successive dips and the species of tick to be killed. The South African ticks may be divided into three classes. The one which is most easily killed is the Blue tick. The Bont tick and the Bont-legged tick (*Amblyomma hebraeum* and *Hyalomma aegyptium*) are the most difficult to kill. The Brown tick (*R. appendiculatus*) has so short a life-cycle that dipping must be repeated at frequent intervals.

It has been found that the addition of an emulsion to a dip allows the proportion of arsenic present to be reduced without rendering the dip less effective, and this also prevents undue interference with the work of the animals dipped. It is pointed out that sheep should be dipped in a special tank, as if they are passed through a tank that is used for cattle some of the hair shed by the latter gets into the wool and causes trouble in working it.

With regard to the manner in which the arsenic gains access to the tissues of the tick, the authors state that experimental inquiry tends to prove that it is imbibed and is not absorbed through the integument.

The explanation offered for the increased effectiveness of a dip containing an emulsion (soap, glue and oil, etc.) is that it has a far greater wetting power, and consequently the proboscis of the tick becomes actually wetted where it penetrates the skin.

An outline is given of experiments that were carried out to determine whether the arsenic is taken by the tick from the skin or from the blood, and the conclusion drawn is that the evidence tends to prove that it is from the skin and not from the blood.

There is also evidence to show that by repeated dipping an animal does accumulate arsenic in its skin up to a certain maximum, the excess being absorbed by the blood vessels and subsequently excreted.

A calculation shows that the quantity of arsenic remaining on the skin after a single dipping is about 30 grammes, i.e., a full toxic dose if administered by the mouth. In the short interval dipping system this amount may be applied to the skin of an animal at intervals of a few days for a period of years without producing any symptoms of poisoning.

In view of these facts it appears to be certain that the blood in the superficial capillaries must contain a considerable proportion of arsenic, although this is of course rapidly decreased by dilution with the blood in the general circulation. Since in such diseases as East Coast fever the organism is injected by the tick into the superficial capillaries there is probably sufficient arsenic there to kill them. This view appears to be borne out in practice. Animals that are regularly dipped could run on infected pasture without contracting the infection.

Reference is frequently made in this paper to the work done by WATKINS-PITCHFORD who investigated the same subjects, and many of whose results the present authors confirm.

Experiments are now being carried out in the Congo by Cooper in connection with the effects of dipping upon trypanosomiasis; dipping affording a means of administering arsenic in considerable doses without risk of poisoning. It is suggested that, in view of the conclusions arrived at as to the means by which ticks acquire the arsenic from dipped animals and the cumulative action of it in the skin, tsetse flies might also be killed in exactly the same manner as ticks. It would appear that dipping might act both as a curative and as a prophylactic measure.

In a number of appendices details are given of many of the experiments performed, and the objections that have been raised to the use of an emulsion in conjunction with the arsenic are criticised.

REPORTS.

(259) EGYPT. **Ministry of Agriculture. Annual Report of the Veterinary Service for the Year 1914.** [LITTLEWOOD (W.), Director, Veterinary Service].—49 pp. 1915. Cairo: Govt. Press. [Price P.T.5.]

In addition to the report regarding the contagious diseases this publication contains also those of the Veterinary Pathological Laboratory and the School of Veterinary Medicine.

Section 1. Contagious Diseases.—

Cattle Plague. This disease was responsible for 1,348 deaths during the year, including 166 following double inoculation in outbreaks. The death-rate from natural infection was 0.11 per cent. as against 0.14 per cent. for the previous year. Nearly all the outbreaks were dealt with by double inoculation with serum and virulent blood, but in some cases virulent nasal discharge was used. The total number of cattle inoculated was 290,726, and the total number of deaths was 4,215, but of these 3,419 were due to diseases other than cattle plague.

Six hundred and eighty-one animals, which had been immunised in June and July 1912, were tested with virulent blood and no cases of the disease occurred. A further batch of animals immunised two and a half years previously were inoculated with virulent blood and equally good results were obtained.

Rabies. During the year 58 cases were reported. Of these 53 were in dogs, 1 in a cat, 3 in wolves, and 1 in a cow. It is said that the disease is now firmly established in the country, and that owing to the large number of uncontrolled dogs its suppression will be almost impossible.

Glanders. 41 cases were detected as against 66 during the previous year.

Epizootic lymphangitis. 27 cases were reported as against 20 for the preceding year.

Anthrax. There is a large decrease in the number of deaths from anthrax reported, the figures being 224 as against 544 for 1913.

Sheep Pox. The number of cases for 1914 and 1913 were respectively 270 and 132.

Foot and Mouth Disease. There were 254 outbreaks and 3,701 cases. It is said that the disease undoubtedly existed in many localities other than those from which it was reported. The mortality was very low, and as a rule the cultivation of the land was not hindered. A tabular statement gives the available figures regarding the occurrence of the disease in the various European countries during the same period.

Haemorrhagic Septicaemia. Eighty-four cases of this disease were reported, and warning was issued as to the danger of permitting animals to drink stagnant water.

Nine cases of *Spirochaetosis* were reported as occurring in fowls.

Trypanosomiasis. There were reported 28 cases in camels, one in a horse, and seven in Sudanese cattle.

Filariasis was detected in two camels and in one horse.

Piroplasmosis in Egyptian Cattle. During the year, 1,856 cases were reported. Many of these followed the double inoculation. 1,445 animals died.

Between 50 and 60 cases of piroplasmosis have been discovered in Sudanese cattle and sheep. These diseases are dealt with at some length in the Report of the Pathologist.

Contagious Bovine Pleuro-pneumonia. The Sudan Government reported 3,053 cases. Seventy-five cases were detected in Egypt, all of which had apparently been imported from the Sudan.

Section 2. Report of the Pathological Laboratory.—

Piroplasmosis in Sudanese cattle.—

During the year thirty-nine cases of this disease, which has the characters of East Coast fever, were discovered.

The disease is usually a subacute one. The lesions are: Oedema of the lungs, with in some cases infarcts and haemorrhagic spots on the pleura. The spleen is usually moderately enlarged and somewhat softened. The lymphatic glands are enlarged and oedematous. The liver sometimes contains infarcts and is congested. The abomasum contains numerous haemorrhagic spots and crater-like ulcerations. The intestine, especially the small intestine and the caecum, shows some degree of inflammation. The kidneys show infarcts.

In the blood of animals which succumb large numbers of small piroplasms are found, the majority of which were rod-shaped. Blue bodies are found in the spleen, glands, infarcts in the kidneys, in the ulcerations in the abomasum, and in the lesions generally.

East Coast fever has not yet been detected in Egyptian cattle although it has been looked for for several years. Inoculation of Egyptian cattle with blood from Sudanese cattle failed to set up infection, and experiments are being carried out to test the infectivity of gland material containing blue bodies.

No cases developed in animals after a period of three weeks' quarantine.

While the disease closely resembles East Coast fever the author hesitates to class it definitely as that disease, in view of the fact that bodies indistinguishable from Koch's blue bodies have been found in cattle and in sheep suffering from diseases that are certainly distinguishable from East Coast fever.

Piroplasmosis in Sudanese sheep.—

Two cases of a form of piroplasmosis hitherto undescribed have been encountered in sheep among quarantined animals at Cairo. Blood films showed a moderately heavy infection with parasites smaller than those of East Coast fever. The majority of the parasites were rod-like, but ring forms were found. More than three parasites were never found in a single corpuscle, and in most cases only one was present. The fact that blue bodies were present in the spleen places the organism among the Theileria.

During life the animals showed a high temperature, profuse nasal discharge, and jaundice. They were only observed to be ill on the day preceding death.

At the post-mortem the following lesions were found :

There was marked jaundice. The peritoneal cavity contained some dirty greenish liquid. The liver and spleen were enlarged. The kidneys were enlarged, congested, and contained white infarcts. The lymphatic glands were enlarged and haemorrhagic.

Egyptian Fever. This is a piroplasmosis of Egyptian cattle which differs from East Coast fever and from Texas fever. In most cases the disease would pass unnoticed unless daily temperatures were taken and blood examinations made during the periods of fever. It is said that if these steps are taken with almost any batch of apparently healthy cattle cases of infection will be detected.

The parasites discovered during the febrile periods are small piroplasms, the majority of which are ring-shaped. Rod and pear-shaped forms may also be found. In these cases the parasites are extremely scanty in the blood ; only two or three may be found in a whole blood film. Repeated examinations of material taken from the enlarged superficial glands during the febrile periods have failed to reveal the presence of blue bodies. Recrudescences of fever associated with the presence of the parasite in the blood may occur from time to time.

More severe attacks of the disease have been seen which closely resemble Texas fever clinically save for the absence of haemoglobinuria. These attacks generally last for about four days.

The lesions found in cases of this disease are : Linear and pin-head ulcerations in the abomasum. Spleen normal save possibly for a few haemorrhagic spots. Oedema and congestion of the lymphatic glands in general.

This disease is likely to make its appearance in from six to twelve days after a double inoculation against rinderpest. It has often been observed that the febrile attack produced under these conditions is interrupted after a day or two by an interval of two or three days when the temperature returns to the normal.

Trypanblue and arrhenal are apparently entirely without any effect upon Egyptian fever.

Occasionally a fatal case occurs. In these 80 to 90 per cent. of the corpuscles may contain parasites, and four or five may be present in each. In these cases haemoglobinuria has been observed. The spleen is sometimes enlarged, and the kidneys contain numerous minute infarcts. Blue bodies have never been found in any of the lesions.

The transmitting tick is *Margaropus annulatus*.

Coccidiosis has been found in both sheep and goats, and it is said that the diseases are reciprocally transmissible by feeding with sporulating oocysts, but that the parasite obtained from sheep is incapable of infecting fowls. A negative result was also obtained in an experiment in which a monkey and a bull were fed.

Filariasis in the horse. Although *Filaria equina* has long been known to be commonly present in the peritoneal cavity of equidae without giving rise to any symptoms, cases are occasionally seen in which embryos (*Filaria sanguinis equi*) are present in the circulation and which are characterised by the presence of petechiae on the mucous membranes that are yellowish in colour, anaemia, and wasting.

Vermineous aneurism of the aorta in cattle.—

This condition has been observed in large numbers of Egyptian cattle, and less frequently in buffaloes. The causal parasite has been identified as *Onchocerca armillata*.

In cases where the lesions are least marked the tunica intima shows a few slightly raised tortuous lines of a yellowish colour about 5 centimetres in length. The worms in such lesions are often partly calcified. Embryos are frequently found in the canal with the adult and in the adjacent connective tissue.

At a later stage there are nodules about the size of peas projecting into the lumen of the invaded vessels.

In advanced cases the whole of the aorta may show tortuous elevated lines, nodules and roughened areas due to the presence of plates of calcareous material. There may also be aneurism.

(260) SOUTHERN RHODESIA. **Report of the Veterinary Bacteriologist, for the Year 1914.** [BEVAN (L. E. W.), Veterinary Bacteriologist.] 5 pp. f'cap.

East Coast Fever.—The number of preparations examined was less than in previous years, probably owing to the introduction of systematic dipping.

The Plasmoses continue to be responsible for enormous losses. Until systematic dipping becomes universal certain disadvantages attach to its employment, for example, the limitation of movement of cattle born upon clean areas, as these readily contract redwater when transferred to infested veldt. While redwater readily yields to regular dipping, anaplasmosis is not so easily eliminated. In one instance blood from a nine-months-old heifer, born and running since birth on an area where five-day dipping has been practised for five years under Government supervision, gave rise to fatal anaplasmosis when inoculated into an animal newly arrived from Great Britain.

Experiments to discover a drug which could be used successfully against the disease yielded entirely negative results. A search for a strain of the virus which would provoke mild reactions was successful,

and vaccinated animals are being exposed to natural infection. It is pointed out that the mild course of the disease which is produced experimentally is to a large extent dependent upon the animals being kept under good hygienic conditions.

Trypanosomiasis. During recent years *G. morsitans* has increased in numbers and has acquired a wider distribution. It has shown a tendency to re-establish itself in areas from which it disappeared at the time of the great rinderpest scourge. Recently the trypanosome discovered in 1913, and indistinguishable from *T. brucei* v. *rhodesiense* of Northern Rhodesia, has been found to have a much wider distribution than was at first recognised, and there is a serious risk that, with the extension of the fly, it may become a source of very grave danger.

Considerable success followed the treatment of animals for trypanosomiasis, but it would appear that in the greater number of animals the trypanosome is not actually destroyed, and that reduction of vitality of the animal from any cause may lead to the infection getting the upper hand again.

Contagious abortion. Experiments have shown that contagious abortion in cattle in Great Britain, British East Africa, Union of South Africa, and Rhodesia are all due to the same organism. It would appear that the disease originated from a Devon bull which was introduced about five years ago. The results produced in the herd into which this animal was brought were so disastrous that the owner sold up his stock and farm. This led to the dissemination of the disease. It would seem, however, that outbreaks at the present time are less serious than formerly. Factors which tend to hinder the spread of the disease are the existence of a well-marked calving period, and the probably rapid destruction of contamination on the land during the dry season. It was found that there was no risk of infecting clean animals by passing them through a dip through which infected animals had been passed, as the dip was rapidly fatal to the causal organism.

Inquiries are being made into the subject of preparing vaccines.

Horse Sickness. No figures regarding the losses are available. The records of horses previously vaccinated are satisfactory. Thirteen of the seventeen vaccinated have been traced. Of these three are known to have died; the remaining ten are still alive although exposed in dangerous districts.

(261) SOUTHERN RHODESIA. **Report of the Chief Veterinary Surgeon, for the Year 1914.** [SINCLAIR (J. M.), Chief Veterinary Surgeon.] 6 pp. f'cap.

The most important work is that in connection with *African Coast Fever*. There are two points which require solution: the occurrence of a single case in a herd, and the recrudescence of the disease in old centres of infection, in some cases after the lapse of several years.

During the year six outbreaks occurred, but it is doubtful whether these were recrudescences or extensions. The number of animals lost was 199. Although this figure is somewhat higher than that for the previous year, it is seen that progress has been made when the areas involved are taken into consideration.

The value of dipping regularly is well recognised, and the number of tanks now in use is 430.

The centres of infection of *contagious abortion* so far discovered number four. The disease appears to be less virulent than in England, as a smaller number of animals in a herd abort.

Glanders. 681 horses, 231 mules, and 1,743 donkeys were tested with mallein on importation, but no reactions were obtained.

Rinderpest. During the first half of the year the disease had not spread in a southerly direction, and arrangements have been made to prevent its introduction from German territory.

No cases of anthrax, pleuro-pneumonia, black quarter, or rabies have occurred.

Scab in sheep and goats. The prevalence of this disease does not appear to be so great as was supposed, and with the exception of advanced cases in the goat it readily yields to treatment.

Gall-lamziekte. The view previously expressed—that this disease would have made its appearance in Rhodesia long ago if it were capable of being introduced by cattle—was strengthened by a visit to infected areas and by inquiries and investigations regarding the occurrence of the disease there.

With regard to the view recently expressed that it is due to sarcosporidia, it is merely recorded that these parasites have been found in widely separated areas in Southern Rhodesia.

Importation of Cattle from Texas.—

The following summary is extracted from the report of the Chief Veterinary Surgeon :—

1. There is, in his opinion, no disease of cattle in Texas which, with ordinary precautions, is likely to be imported into Rhodesia by the transfer of Texan cattle.

2. Before any general importation is permitted, a small preliminary consignment should be obtained and forwarded to the Veterinary Laboratory, Salisbury, in order (a) to carry out certain blood tests, which, after consideration by the Administration on the representation of the Agricultural Union, were considered necessary before cattle from any tropical or semi-tropical country should be generally admitted ; (b) to determine what immunity, if any, Texan cattle possess against anaplasmosis (gall-sickness).

3. In importing cattle, certain precautions would have to be observed and certain tests made :—

(a). The testing of all animals prior to shipment for tuberculosis and infectious abortion.

(b). Inspection immediately prior to shipment by a Federal Veterinary Officer.

(c). General health certificate.

(d). Special certificate in regard to freedom from scabies.

(e). Precautions to be taken that cattle are tick free.

(f). Cattle from tick-infested areas only to be imported.

The last point should be insisted on in the owners' interests.

- (262) TRINIDAD AND TOBAGO. **Report of the Government Veterinary Surgeon for the Year 1914-15.** [MILLER (J. D.)]—4 pp. f'cap. 1915. Port-of-Spain: Govt. Printing Office,

With the exception of anthrax among cattle imported from Venezuela there have been no contagious diseases among imported animals. Venezuelan animals are vaccinated against anthrax before being issued from quarantine. Anthrax regulations are in force against St. Vincent and Demerara.

Quarantine regulations are in force against imported dogs for a period of six months owing to a rather severe outbreak of hydrophobia.

Cattle and swine from the United States are quarantined for a month on account of Texas fever and swine plague (? fever).

- (263) NIGERIA. **Annual Report of the Agricultural Department Northern Provinces for 1914. Report of the Veterinary Department.** [BRANDT (F. R.)]—Appendix 1. pp. 6-10. Lagos: Govt. Printer.

The following is an abstract of this report as far as it concerns the diseases of animals.

Trypanosomiasis. In every province there are areas where cattle cannot be kept, and the greater part of Kontagora and the districts bordering on the Niger and Benue rivers are danger zones, especially during the wet season.

Pleuro-pneumonia is known throughout the Northern Provinces and small outbreaks are not infrequent. The Fulani have a method of protective inoculation by which a piece of diseased lung is inoculated into the face of susceptible animals. The enormous swelling which results sometimes causes death.

Foot and Mouth Disease is said to occur, and the natives describe a disease which is probably *anthrax*.

Liver fluke is common.

Although ticks of several varieties are found no evidence has so far been obtained of the occurrence of tick-borne diseases, but a thorough examination must be made before any definite information on this point can be obtained.

Trypanosomes of two distinct types have been found in horses. One of these resembles *T. nanum* and was responsible for a fatal termination in every case seen, and the other, which is apparently of the *vivax* type, either is less virulent or produces a more chronic disease.

Although the parasite has not yet been demonstrated it appears to be probable that *epizootic lymphangitis* occurs, and in some parts is the cause of considerable detriment to the horse industry. There is no report of diseases affecting sheep and goats.

- (264) UGANDA PROTECTORATE. **Annual Report of the Department of Agriculture for the Year ending March 31, 1915. Veterinary Division.** [HUTCHINS (E.), Chief Veterinary Officer.] 1915. Kampala: Uganda Printing and Publishing Co., Ltd.

Rinderpest. The total number of adult animals and calves inoculated by the virulent blood and serum method in the Buganda

Province were 3,058 and 848, and the deaths in the two classes were 196 and 210 respectively. The large number of deaths was mainly accounted for by the fact that the disease had appeared in some of the herds. Serum alone, followed by mixing the animals with those already infected, was found to be an unsatisfactory method.

In 41 cases permanganate of potash was used for the treatment of the disease in the early stages. Only 20 per cent. of the animals died. The mortality in untreated cases is over 70 per cent.

Difficulties have been encountered through the spread of the disease by game, and experience has shown that quarantine methods, though checking the formation of new centres if rigidly enforced, are useless for the stamping out of the disease.

Lack of sufficient staff has prevented the disease from being fully controlled in the Eastern Province. In the Northern Province the disease has not been so severe as formerly, and it has not yet made its appearance in the Western Province.

Foot and mouth disease has been very prevalent among the Mbarara herds, but the economic loss is not serious except in transport animals.

East Coast Fever. This disease has not come much under notice except in calves.

Horse sickness has been found in large numbers of imported mules.

Scabies has been responsible for considerable losses among goats, and *contagious pleuro-pneumonia* is very wide spread in the same species.

Canine piroplasmiasis is very common, but generally yields to treatment with trypanblue.

(RICHARDSON U.F.). An outbreak of trypanosomiasis due to *T. pecorum* occurred in September 1914. The herd from which these animals came was examined and infected animals were isolated. Subsequently numbers of animals in different ownerships were found to be infected and *T. vivax* was found. In all about 150 animals died.

It was at first thought that *G. palpalis* was responsible for the transmission, and subsequently when *T. vivax* was found the view was taken that tsetse must be held responsible. Search failed to reveal their presence.

“The course of the disease resembled that described when mechanical transmission by the agency of Tabanidae, and possibly Stomoxys, was the method of infection. That is, although all the cattle were treated in much the same way and grazed on the same ground, they were not uniformly affected.”

A number of different drugs were tried for the treatment of infected animals, but none was successful in effecting a cure, though orpiment in ball or as an electuary yielded the best results. The dose was 8 to 12 grammes.

(265) NYASALAND PROTECTORATE. **Annual Report of the Department of Agriculture for the Year ending March 31, 1915. Veterinary Division.** [GARDEN (G.), Senior Veterinary Officer.]—pp. 29–32. 1915. Zomba: Govt. Printer. [Price 6d.]

Rinderpest has not occurred in the Protectorate. On the outbreak of war the herds were moved away from the border and there is a cattle free belt from nine to fifteen miles wide.

Trypanosomiasis. An outbreak of trypanosomiasis occurred in the Fort Johnston District and resulted in the death of a large number of animals. In tracing the transmitting agent, it was interesting and important to discover that two fly areas formerly divided by the river had become united as a result of the reduction in width of the river from 120 to 50 yards and the disappearance of the current.

A preliminary survey in the Northern District appears to indicate that the fly areas are increasing.

Owing to the absence of many owners on active service and the necessary employment of the veterinary officers on other work, demodectic mange has made progress. Eradication of the disease cannot be taken in hand until slaughter of affected and in-contact animals, coupled with regular dipping, is possible.

East Coast Fever. The work of investigating the distribution of this disease had to be suspended.

There have been no serious outbreaks of disease due to *Anaplasma marginale* or *Piroplasma mutans*.

Regular spraying has accounted for a diminution in the number of cases and also a marked decrease in the number of ticks.

BOOK REVIEW.

(266) HOBDAY (Frederick) (T. G.) [F.R.C.V.S., F.R.S.E.] **Anaesthesia and Narcosis of Animals and Birds.**—xi + 86 pp. With 24 figs. 1915. London: Baillière, Tindall & Cox. [Price 5s. net.]

This small work bears a pretentious title which is hardly justified by the contents. Much more attention is given to anaesthesia of the horse and dog than to that of the other domestic animals, and very little to that of birds.

The aim of the book is distinctly commendable, though in places the performance is meagre or unsatisfactory. A somewhat apologetic preface bewails the slow progress of anaesthesia in veterinary surgery, a reproach which is amended in the first chapter by the welcome admission that "anaesthetics are now almost universally employed, at all events in the British Isles, for all major operations" on the horse. The ox, sheep, and pig, as subjects of anaesthesia, do not bulk largely in any veterinary practice, though not for the want, as the author states, of a safe and convenient narcotic or anaesthetic, but mainly for the reason that operations on these animals are restricted to small economical efforts by the surgeon, who can hardly be blamed for not resorting more frequently to anaesthetics when operating on the animals of the farm.

Both general and local anaesthetics are discussed, and the usual methods of administration are fully described, but more information might have been given concerning the effects of narcotics and anaesthetics, not only on the horse but also on the other domestic animals. Intraspinal anaesthesia, which is never likely to meet with more than a very limited employment in veterinary practice, receives adequate attention in a long illustrated abstract of a thesis on the subject by a French veterinarian, M. MENNERAT. More than one fourth of the book is devoted to cocaine and other local anaesthetics, including ethyl chloride and the rarely used ether spray. A curious explanation of the action of narcotics (chloral hydrate, morphia, and scopolamine—the "twilight dream" of parturient women) appears on page 74:—"There are certain agents which do not always absolutely abolish pain to such a complete extent that they can be termed 'true

anaesthetics,' but they have such a numbing effect upon the senses of animals that operations can be performed upon them without evidence of any great pain. . . ."

But no fault will be found with the author's conclusion regarding the value of morphia in canine practice :—"As a narcotic [morphia] acts so well in the dog, and is so safe to administer, that its use has almost superseded chloroform even for very severe operations."

The eleven chapters of the book are very unequal in merit; two or three are excellent, but several betray haste or uncertain knowledge. Important points are sometimes dismissed in a few lines, barren of instruction. Here and there the information is scrappy, frequently exciting but seldom sustaining the interest of the reader. It is difficult to discover any useful purpose in some passages, for example :—"The horse, dog, and pig have each one stomach; the ox, sheep, and goat each have four; the camel has three, and some of these are intractable and very bulky animals, and have to be operated upon in all kinds of improvised situations where they cannot be placed gently on neat operating tables, as with human patients, nor will they remain quiet and refrain from struggling at the mere request of the doctors and nurses." Verbiage of this sort can only be regarded as poor fodder for veterinary students who may be bent on becoming experts in anaesthesia.

The method recommended to terminate the life of the next-to-human dog may be quoted :—"The preliminary use of morphia hypodermically is most excellent when it is necessary to destroy a dog, this being followed up by chloroform inhalation in about twenty or thirty minutes, and finally a dose of Scheele's hydrocyanic acid into the chest when the chloroform has produced unconsciousness." Poor dog! These are war times, but surely the dog-owner not bereft of humaneness would not care to witness this tedious process of "painless destruction."

The proof-reader of this book cannot be congratulated on his vigilance or accuracy, but the publishers deserve commendation.

J. Macqueen.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 3, No. 3, pp. 115-116.]

Babesiasis.

- (267) CARPANO (M.) La febbre della costa mediterranea. Piroplasmosi tipo "parvum" nei bovini del basso bacino del mediterraneo. [Mediterranean Coast Fever. Piroplasmosis of the Parvum Type in Cattle on the Southern Coast of the Mediterranean.]—*Ann. d'Igiene Sperimentale*, 1915. Vol. 25. No. 4, pp. 343-410. With 2 plates and 12 text-figs.

Leishmaniasis.

- (268) KOKORIS (D.). Ueber die Splenecktomie bei Kala-Azar. [Splenectomy in Kala-Azar.]—*München. Med. Woch.*, 1915. July 27. Vol. 62. No. 30, pp. 1008-1009.

Malaria.

- (269) ZIEMANN (H.). Ueber eigenartige Malariaparasitenformen. [Peculiar Forms of Malaria Parasites.]—*Centralbl. f. Bakt.*, 1. Abt. Orig., 1915. July 10. Vol. 76. No. 5, pp. 384-391. With 1 coloured plate comprising 45 figs.

Rabies.

- (270) CORNWALL (J. W.) & IYER (S. R.). Arneith's Index and Anti-Rabic Treatment.—*Indian Jl. Med. Res.*, 1915. July. Vol. 3. No. 1, pp. 132-134.

Trypanosomiasis.

- (271) van den BRANDEN. Le sel sodique du Salvarsan cuprique dans le traitement de la Trypanose humaine, du Pian et de la Syphilis. [The Soda Salt of Copper Salvarsan in the Treatment of Human Trypanosomiasis, Pian, and Syphilis.]—*Bull. Soc. Path. Exot.*, 1915. Oct. Vol. 8. No. 8, pp. 582-586.
- (272) FRANÇA (C.). Le trypanosoma inopinatum. [Trypanosoma inopinatum.]—*Arch. f. Protistenk.*, 1915. Oct. 8. Vol. 36. No. 1, pp. 1-12. With 1 coloured plate comprising 17 figs.

Biting Flies and Ticks.

- (273) AWATI (P. R.). Studies in Flies. 1. Chaetotaxy and Pilotaxy of Muscidae and Range of their Variability in the same Species.—*Indian Jl. Med. Res.*, 1915. Vol. 3. No. 1, pp. 135-148. With 3 plates and 6 text-figs.
- (274) BÉGUET (M.). Deuxième Campagne contre les Sauterelles (*Stauronotus maroccanus* Thun.) en Algérie, au Moyen du "Coccobacillus acridiorum" d'Hérelle. [Second Campaign against the Locusts in Algeria (*Stauronotus maroccanus* Thun.) by Means of the "Coccobacillus acridiorum" of d'Hérelle.]—*Ann. Inst. Pasteur*, 1915. Oct. Vol. 29. No. 10, pp. 520-536.
- (275) CHRISTOPHERS (S. R.) & KHAZAN CHAND. Notes on Some Anophelines from Arabia and Mesopotamia.—*Indian Jl. Med. Res.*, 1915. July. Vol. 3. No. 1, pp. 180-200. With 2 plates comprising 10 figs.
- (276) DRAKE-BROCKMAN (R. E.). Some Notes on the Bionomics of *Ornithodoros savignyi* in British Somaliland.—*Bull. Entom. Res.*, 1915. Sept. Vol. 6. No. 2, pp. 195-196.
- (277) HIRST (S.). On Some New Acarine Parasites of Rats.—*Bull. Entom. Res.*, 1915. Sept. Vol. 6. No. 2, pp. 183-190. With 8 text-figs.
- (278) KING (H. H.). Preliminary Notes on the Life-History of *Argas brumpti* Neumann.—*Bull. Entom. Res.*, 1915. Sept. Vol. 6. No. 2, pp. 191-193.

- (279) LUDLOW (C. S.). The Synonymy of *Anopheles christophersi*, Theo., and *A. indefinita*, Ludl.—*Bull. Entom. Res.*, 1915. Sept. Vol. 6. No. 2, pp. 155-157.
- (280) RODHAIN (J.) & HOUSSIAU (J.). Dermatite vésiculeuse saisonnière produite par un coléoptère. [A Seasonal Vesicular Dermatitis caused by a Coleopteron.]—*Bull. Soc. Path. Exot.*, 1915. Oct. Vol. 8. No. 8, pp. 587-591. With 1 plate and 1 text-fig.
- (281) RODHAIN (J.) & VILLENEUVE (J.). *Passeromyia*, genre nouveau des Anthomyidae (Dipt.), à larve hématophage parasite des jeunes oiseaux. [*Passeromyia* a New Genus of Anthomyidae (Dipt.) with Hematophagous Larval Parasitic on Young Birds.]—*Bull. Soc. Path. Exot.*, 1915. Oct. Vol. 8. No. 8. pp. 591-593.
- (282) STANTON (A. T.). The Larvae of Malayan Anopheles.—*Bull. Entom. Res.*, 1915. Sept. Vol. 6. No. 2, pp. 159-172. With 15 text-figs.
- (283) STRICKLAND (C.). Note on *Anopheles brevipalpis* Roper, and Description of its Egg and Larva.—*Indian Jl. Med. Res.*, 1915. July. Vol. 3. No. 1, pp. 201-204. With 1 plate comprising 6 figs.

Helminths.

- (284) KOBAYASHI (H.). On the Life-History and Morphology of *Clonorchis sinensis*.—*Centralbl. f. Bakt.*, 1. Abt. Orig., 1915. Jan. 15. Vol. 75. No. 4, pp. 299-318. With 4 plates comprising 38 figs.
- (285) LANE (C.). *Falcaustra falcata*. An Investigation of *Oxysoma falcatum* von Linstow, 1906.—*Indian Jl. Med. Res.*, 1915. July. Vol. 3. No. 1, pp. 109-115. With 2 plates comprising 9 figs.

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- (286) GALLI-VALERIO (B.). Notes de parasitologie et de technique parasitologique. [Notes on Parasitology and Parasitological Technique.]—*Centralbl. f. Bakt.*, 1. Abt. Orig., 1914. Aug. 29. Vol. 75. No. 1, pp. 46-53. With 5 text-figs.
- (287) HADWEN (S.). A Study of Haematuria in France and other Countries.—*Report of Veterinary Director General, Canada, for Year ending Mar. 31, 1914*. Appendix No. 21, pp. 119-128.
- (288) RETTERER (Ed.). Des hématies du chien. [The Blood Corpuscles of the Dog.]—*C.R. Soc. Biol.*, 1915. Oct. 22. Vol. 78. No. 15, pp. 496-500.
- (289) RETTERER (Ed.) & NEUVILLE (H.). Des hématies de l'éléphant, du chameau, et du lama. [The Blood Corpuscles of the Elephant, Camel, and Llama.]—*C.R. Soc. Biol.*, 1915. Oct. 22. Vol. 78. No. 15, pp. 500-503.
- (290) WHERRY (W. B.). A Plague-like Disease of California Ground Squirrels affecting Man in Ohio.—*Jl. Amer. Med. Assoc.*, 1915. Oct. 30. Vol. 65. No. 18, p. 1549.

INDEX OF AUTHORS.

The numbers in heavy type indicate Abstracts, and those in light type
References (Recent Literature).

A.

Adie (Helen), **90**.
Amato (A.), **247**.
Archibald (R. G.), **3**, **19**.
Aubert (P.), **61**, 115, 193.
Awati (P. R.), 273.

B.

Banham (G. A.), **188**.
Barker (F. D.), 207.
Beal (W. P. B.), **36**.
Béguet (M.), 274.
Bellevall (G.), **140**.
Bequaert (J.), **177**, 194, 203, **245**.
Bevan (L. E. W.), **186**, **260**.
Blacklock (B.), **148**, **165**, **172**, **176**,
181.
Boquet (A.), **1**, **103**, **111**, **184**.
Bouet (G.), 195.
Bouilliez (M.), **25**, **239**.
van den Branden (F.), 152, 271.
Brandt (F. R.), **263**.
Brown (H. C.), 134.
Brown (W. H.), **71**.
Bruce (D.), **5**, **6**, **8**, **9**, **10**, **16**.
Bruce (Lady), **5**, **6**, **8**, **9**, **10**.
Burgess (E.), **256**.

C.

Carini (A.), **72**, **231**.
Caronia (G.), **78**.
Carpano (M.), **135**, 267.
Carter (H. F.), 117.
Chalmers (A. J.), **3**.
Chand (K.), 275.
Chapin (R. M.), **109**.
Chatelain (M.), 213.
Chatterjee (G. C.), **35**.
Chatton (E.), **21**.

Christophers (S. R.), 275.
Christopherson (J. B.), 41.
Ciuca (M.), **15**.
Ciurea (J.), **241**.
Coca (A. F.), **257**.
Coles (A. C.), **221**.
Cooper (W. F.), **258**.
Cornwall (J. W.), 45, 270.
Cort (W. W.), 49.
Cottes (J. D.), 116.
Cragg (F. W.), 118, 119.
Craig (C. F.), 53.
Cristina (G.), **78**.
Cunha (R. de A.), 120.

D.

Delanoë (P.), **67**, **138**, **142**.
Delanoë (Mme.), **142**.
Demidoff (A. P.), 130.
Dobell (C.), **232**.
Drake-Brockman (R. E.), 276.
Dubois (A.), **152**.
Duboscq (O.), 132.
Duke (H. L.), **66**.
Dupont (V.), **64**.

E.

Edwards (F. W.), 196, 197.
Eminson (R. A. F.), 179.

F.

Fantham (H. B.), **23**, 54, **166**, **167**,
192.
Fermi (C.), **248**, **249**, **250**, **251**.
Fiori (C.), **142**.
França (C.), **88**, 272.
Franchi (A. F.), 208.
Franchini (G.), 55, **169**.

G.

Gaiger (S. H.), 92, 243.
 Gallagher (G. H.), 7, 11.
 Galli-Valerio (B.), 286.
 Ganguly (H. C.), 27.
 Garden (G.), 265.
 Gilbert (Ruth), 83.
 Giugni (F.), 79.
 Gonder (R.), 91.
 Gózony (L.), 4.
 Gray (C. E.), 187.
 Graybill (H. W.), 107, 108.
 Griffiths (J. A.), 100.

H.

Hadwen (S.), 121, 287.
 Hall (M. C.), 173.
 Hamerton (A. E.), 5, 6, 8, 9, 10.
 Harrison (L.), 122, 198, 199.
 Hawke (W. L.), 220.
 Heckenroth (F.), 77.
 Hedinger, 185.
 Henry (A.), 94, 210.
 Henry (M.), 106.
 Heymann (P.), 163.
 Hill (F.), 236.
 Hindle (E.), 4, 224.
 Hirsch (E. F.), 129.
 Hirst (S.), 183, 277.
 Hobday (F. T. G.), 266.
 Holmes (J. D. E.), 33.
 Hopkins (J. G.), 83, 159.
 Houssiau (J.), 280.
 Hutchins (E.), 264.

I.

Iyer (S. R.), 270.

J.

Jameson (A. P.), 232.
 Jones (H. Ll.), 153.
 Jorge (R.), 116.

K.

Kerandel (J.), 102.
 King (H. H.), 278.
 Kirwan (E. W. O'G.), 134.

Kobayshi (H.), 284.
 Kokoris (D.), 268.
 Kolmer (J. A.), 110, 147.
 Koselkin (P. M.), 130.
 Krumweide (C.), jr., 99.
 Kuehn (A.), 131.

L.

Lafont (A.), 64, 77.
 Lamborn (W. A.), 180.
 Landes (L.), 69.
 Lane (C.), 29, 237, 285.
 Lanfranchi (A.), 59, 141.
 Lapage (G.), 86.
 Launoy (L.), 160.
 Laveran (A.), 13, 14, 18, 22, 55,
 62, 76, 85, 145, 151, 156, 157,
 169, 189, 223, 225.
 Laws (H. E.), 258.
 Lawson (M. R.), 161.
 Leger (L.), 132.
 Leiper (R. T.), 3, 238.
 Lemaire (G.), 190, 227.
 Lévy-Bruhl (M.), 160.
 Lhéritier (A.), 1, 69, 140.
 Lignos (A.), 112.
 Littlewood (W.), 38, 259.
 Low (G. C.), 31.
 Ludlow (C. S.), 279.
 Lutz (A.), 123.

M.

Macfarlane (H.), 200.
 Macfie (J. W. Scott), 11, 24.
 McEachran (J. F.), 236.
 MacGregor (M. E.), 244.
 Maciel (J.), 72, 231.
 Mackie (F. P.), 42, 43, 229.
 M'Leod (J. W.), 34.
 Maggio (C.), 222.
 Mann (Alice G.), 99.
 Marmer (R.), 139.
 Martoglio (F.), 252.
 Masson (P.), 101.
 Mathis (C.), 163.
 Meggitt (F. J.), 175.
 de Mello (F.), 234.
 Mesnil (F.), 63, 89.
 Meyer (K. F.), 246.
 Micheli (M.), 61.

Miller (J. D.), **262**.
 Minchin (E. A.), **74**.
 Mitra (S. B.), **27**.
 Mitter (S. N.), **32**.
 Mitzmain (M. B.), **174**.
 Moon (V. H.), **98**.
 Moroff (T.), **133**.
 Motais (F.), **63**.

N.

Neave (S. A.), **178**.
 Nègre (L.), **103**, **116**, **184**.
 Neiva (A.), **123**.
 Neuville (H.), **289**.
 Nicoll (W.), **26**, **209**.
 Nicolle (C.), **21**, **116**.
 Nuttall (G. H. F.), **46**, **47**, **124**,
136, **224**.

O.

Ogawa, **12**.
 Ouzilleau (F.), **73**.

P.

Patton (W. S.), **20**, **45**.
 Pavoni (G.), **80**.
 Perekropoff (G. J.), **162**.
 Phisalix (Mme.), **113**.
 Pinoy (E.), **101**.
 Porter (A.), **54**, **56**, **167**.
 Priestley (H.), **137**.

R.

Railliet (A.), **94**, **210**.
 Retterer (E.), **288**, **289**.
 Robinson (L. E.), **201**.
 Rodhain (J.), **168**, **202**, **203**, **280**,
281.
 Rosenbusch (F.), **222**.
 Roubaud (E.), **97**, **125**, **195**.
 Roudsky (D.), **13**.

S.

van Saceghem (R.), **154**, **214**, **215**,
216.
 Sangiorgi (G.), **40**.

Sant'anna (J. F.), **149**.
 Santoliquido, **116**.
 Schochos (N. I.), **130**.
 Schockov (N. F.), **82**.
 Schultz (C. H.), **170**.
 Schwetz (J.), **48**, **126**.
 Seidelin (H.), **17**, **30**, **57**, **65**.
 Sen (S. K.), **127**.
 Senevet (G.), **190**, **227**.
 Sergent (Ed.), **1**, **28**, **69**, **75**, **116**,
140, **190**, **227**.
 Sergent (Et.), **190**, **227**.
 Seurat (L. G.), **50**, **51**, **52**, **93**, **95**,
96, **211**.
 Silva (P. da), **81**.
 Sinclair (J. M.), **39**, **261**.
 Skrjabin (K. J.), **242**.
 Sleeping Sickness Commission,
217.
 Smith (A.), **32**.
 Soga (A. R. B.), **34**.
 Spagnolio (G.), **191**, **228**.
 Spreull (J.), **2**.
 Stanton (A. T.), **204**, **282**.
 Stephens (J. W. W.), **87**.
 Stevenson (A. C.), **233**.
 Stordy (R. J.), **37**.
 Strickland (C.), **114**, **205**, **283**.
 Sweet (G.), **235**.

T.

Terry (B. T.), **70**, **104**, **105**.
 Theiler (A.), **253**.
 Thomson (J. D.), **74**.
 Tirumurti (T. S.), **212**.
 Todd (J. L.), **44**.
 Travassos (L.), **128**.
 Turner (R. E.), **206**.

V.

Vialatte (C.), **68**.
 Villeneuve (J.), **281**.

W.

Ward (H. B.), **129**.
 Wassilewsky (W.), **144**.
 Waterston (J.), **182**.
 Watkins-Pitchford (W.), **240**.

- Watson (E. A.), **218, 219, 254.**
Watson (D. P.), **5, 6, 8, 9, 10.**
Webb (E. Clive), **60.**
Wehrbein (H.), **150.**
Wenyon (C. M.), **31, 58, 164, 226, 230, 233.**
Wherry (W. B.), 290.
Wickware (A. B.), **171.**
Winogradoff (W. W.), 130.
Wolbach (S. B.), **84.**
Woodcock (H. M.), **86.**
Wyssmann (E.), **255.**
- Y.**
- Yakimoff (W. L.), **82, 130, 139, 143, 144, 146, 155, 158.**
Yorke (W.), **148, 165, 172, 176, 181.**
Young (W. J.), **188.**
- Z.**
- Ziemann (H.), 269.
Zins-er (H.), **83, 159.**

SUBJECT INDEX OF PAPERS ABSTRACTED.

The numbers refer to the pages.

- Anaplasmosis,**
Ovine
incidence, 41.
- Babesiasis** (Piroplasmosis). 1-5,
41.
Bovine
cultivation, 25.
incidence, 1, 25, 76, 81, 99, 154.
nomenclature, 3.
transmission, 82.
Egyptian fever of cattle, 155.
Canine
diagnosis, 3.
Equine
incidence, 76.
treatment, 76.
Ovine
incidence, 41, 155.
- Book Reviews,** 114, 161.
- Bugs,** see under Flies, &c.
- Debab El,** see *T. cazalbouii*.
- Dourine,** see *T. equiperdum*.
- Drugs.**
Antimony compounds, 42, 91,
93, 169.
Arrhenal, 155.
Arsenic compounds, 42, 43, 47,
74, 75, 82.
Atoxyl, 42, 47, 72, 92.
Congo Red, 82.
Copaiva, Oil of, 82.
Creosote, 82.
Emetine hydrochloride, 82.
Galyl, 44.
Ludyl, 44.
Mercury compounds, 76, 82, 155,
160.
Metoleine, 42.
Neosalvarsan, 44.
O., 43.
OK₁, 43.
Potassium tartrate, 16.
Quinine, 69, 82.
Salvarsan, 44.
Salvarsan-copper, 44.
Soamin, 82.
Sodium salicylate, 82.
Trypanblue, 76, 155, 160.
Trypasafrol, 82, 90, 125.
"606," 82.
- Epizootic Lymphangitis,** 143.
cultivation, 71.
development of cryptococcus,
111.
incidence, 76, 154, 159.
- Fleas,** see Flies, etc.
- Flies, etc.**
Anopheles costalis, 90.
Atylototus tomentotus, 77.
Atylototus nemoralis, 77.
Auchmeromyia (*Chaeromyia*)
chaerophaga, 142.
Banksinella luteo-lateralis, 90.
Bubalis lelwel jacksoni, herpe-
tomonads in, 100.
Ceratophyllus fasciatus, 50.
Chrysops dimidiata, 13.
Cordylobia anthropophaga, 142.
Ctenopsylla musculi, 101.
Culicoides milnei, 90.
Culiciomyia nebulosa, 90.
Glossinae
control of, 109.
G. brevipalpis
incidence, 117.
G. caligenea
incidence, 10.
G. morsitans
bionomics, 68, 108, 110.
development of *T. brucei* in,
9, 11, 12.
— *T. caprae* in, 5.
incidence, 28, 117, 157.
parasites of, 111.
G. pallidipes
incidence, 117.
G. palpalis
bionomics, 68, 105.
incidence, 10, 105, 106.
infection with *T. congolense*
99.
— *T. vivax*, 99.
G. tachinoides
incidence, 10, 13, 28.
infection with *T. nigeriense*,
13.
— *T. pecaudi*, 13.
— *T. pecorum*, 12.
— *T. vivax*, 13.
spirochaete in gut of, 27.

Flies, etc.—cont.

- Lynchia maura, 64.
- capensis olfersia, 64.
- Phlebotomus
 - Phl. papatasii, 30.
 - minutus africanus, 30.
 - perniciosus, 30.
- Pulex irritans, 56.
- Repellents for flies, 74.
- Stegomyia fasciata, 141.
- Stomoxys calcitrans, 104.
- Tabanidae
 - T. congolensis, 90.
 - T. taeniola variatus.
 - Silvius monticola
 - bionomics and incidence, 90, 107.
- Toxorhynchites (n. sp. ?), 90.
- Triatoma infestans, 124.

Foot and Mouth Disease.

incidence, 154.

Helminthiasis, 28-31, 64-67, 103-105, 130-141.

- in birds, 31, 141.
- cattle, 28, 104, 130, 133, 135, 156.
- dog, 30, 103.
- elephant, 134.
- fox (Algerian), 66, 67.
- gerbil, 65.
- horse, 104, 156.
- mouse, 31.
- pig, 140.
- Allodapa numidica, 67.
- Ascaris hamia, 31.
- Ankylostomum caninum, 103.
- ceylanicum, 103.
- Amira, 135.
- Asifia vasifa, 135.
- Chongianguim epistomum, 135.
- Coenurus (Multiceps) glomeratus, 66.
- Cylicostomum sipunculiforme, 135.
- Decrusia additicia, 135.
- Dermatoxys veligera, 65.
- Dirofilaria immitis, 30.
- Echinostome (sp.) of pig, 140.
- Equinurbia sipunculiformis, 135.
- Filaria (equine)
 - incidence, 156.
 - transmission, 104.
- Ganguleterakis gangula, 31.
- Habronema grimaldiae, 66.
- nouveli, 66.
- Heterakis bosia, 31.
- putaustralis, 31.
- Kathlania kathlena, 31.
- tonandia, 31.
- Murshidia murshidia, 135.
- falcifera, 135.
- Onchocerca armillata, 156.
- gibsoni, 28, 130, 133.

Helminthiasis—cont.

- Quilonia (sp.), 135.
 - Schistosoma bovis, 137.
 - haematobium, 137, 139.
 - mansoni, 139.
 - Spirocerca (Spiroptera) subaequalis, 67.
 - Syngamus laryngeus, 104.
 - Tapeworms in birds, 141.
- Leishmaniasis, 19-23, 53-57, 94-96, 125-127.**
- cultivation, 21, 95.
 - diagnosis, 22, 56.
 - incidence, 21, 57, 94.
 - pathogenicity, 20, 23, 56, 95, 96, 126.
 - transmission, 56, 125, 126, 127.
 - treatment, 56, 57.
- Canine
- incidence, 55, 57, 77, 94, 127.

Leucocytozoa

classification, 62, 63.

Malaria

- Haemoproteus columbae
 - bionomics, 63, 64.
 - transmission, 64.
- P. praecox, 28.
- tenue, 61.
- vivax, 28.
- Tropical malaria
 - bionomics, 98.
 - cultivation, 98.
 - diagnosis, 98.

Miscellaneous

- Abortion, contagious, 112, 157.
- Amboceptor, rapid preparation of, 151.
- Anaerobes, cultivation of in fluid media, 33.
- Bou Frida in goats, 77.
- Cattle, Peculiar Disease of in New South Wales, 73.
- Demodectic mange in cattle, 70.
- Dipping, 74, 75, 153.
- Haemorrhagic Septicaemia, 154.
- Lamziekte, 112, 148.
- Mycetoma in lung of donkey, 70.
- Swine, Disease of in Ceylon, 150.
- Plague, Reservoir of Virus, 71.
- R'Och El of Sheep, 77.
- Sheep Pox, 76, 154.
- Sporothricosis, 143.
- Swamp Fever, 149.
- Vibrio metchnikovi in pheasants, 32.

Mosquitoes, see Flies, etc.**Nagana, see T. brucei.**

- Pleuropneumonia**
Cattle, 154, 159.
Goats, 108.
- Protozoology**, (see also Leucocytozoa, Malaria, and Miscellaneous).
Classification, 62, 63.
Coccidiosis, 101, 128.
Flagellates in insects, 99.
— *Triatoma infestans*, 124.
Flagellate, Free living in water, 34.
Grahamella in rat, 26.
Haemogregarina akodoni, 49.
— francae, 129.
Haemosporidia, Classification of, 63.
Herpetomonads in *Bubalis lelwel jacksoni*, 100.
— *ctenopsylla musculi*, 101.
— cultivation of, 101.
— fleas, 101.
— mice, 100.
— oestridae, 100.
Helkesimastix faecicola, 60.
Klosiella cobayae, 31.
Lankesteria culicis, 129.
Leucocytozoa, Classification of, 62.
Leucocytozoon anatis, 102.
Paraplasma flavigenum, 26, 32.
— *cobayae*, 26.
Pigmented parasites of cold-blooded animals, 98.
Pneumocystis carinii, 127.
Protozoal infection (?) of birds in Nigeria, 27.
- Rabies.**
immunity, 145, 146.
incidence, 153.
treatment, 69.
- Recent Literature** see separate Index to References.
- Reports.**
British East Africa, 35.
Egypt, 36, 153.
Gold Coast, 34.
Nigeria, 159.
Nyasaland, 160.
Rhodesia, Southern, 156, 157.
Texas, Health of Cattle in, 37.
Trinidad and Tobago, 159.
Uganda, 159.
Union of South Africa, 113.
- Rinderpest.**
incidence, 153.
immune bodies, effects of heat on, 33.
protective inoculation, 147, 159.
treatment, 160.
- Sleeping Sickness**, see *T. brucei*,
T. gambiense, *T. rhodesiense*,
T. nigeriense.
- Spirochaetosis**, 24–25, 57–58, 96–97.
bionomics, 24, 58.
cultivation, 33, 57.
immunity, 96, 97.
incidence, 27, 154.
morphology, 24.
- Theileriasis**, 1–5, 81–83.
Bovine
cultivation, 25.
diagnosis, 3.
incidence, 1, 14, 25, 81, 158.
immunity, 1.
transmission, 82.
treatment, 82.
in Guinea-pigs, 26.
Theileria mutans, 99.
— *tachyglossi*, 83.
- Ticks.**
Amblyomma variegatum, 99.
Boophilus australis, 99.
Hyalomma aegyptium, 82.
Margaropus annulatus, 156.
- Toxoplasma gondii**, 59.
- Trypanosomiasis**, 5–19, 41–53, 83–93, 117–125.
General (see also individual trypanosomes).
classification, 17, 44.
development, 5, 9, 45.
diagnosis, 41, 90.
differentiation, 41, 45, 86.
drugs, effects of, 90.
immunity, 9, 15, 16, 47.
incidence, 11, 27, 84, 85, 159.
lesions, 84, 87.
milk, infectivity of, 84.
morphology, 6, 10.
reservoir, 88.
transmission, 88.
treatment, 42, 43.
virulence, 87.
in camel, 154.
— cattle, 154.
— dog, 6, 47.
— donkey, 28, 42.
— dormouse, 15.
— dromedary, 77.
— goat, 15.
— horse, 28, 76, 84, 85, 125, 154.
— man, 6, 12, 27, 44, 88.
— mule, 42.
— rat, 28, 46.
Chagas disease, 124.
T. akodoni, 50.
T. anceps, 8.
T. berberum, 77.

Trypanosomiasis—cont.

- T. brucei
 - development, 9.
 - identity, 6, 12.
 - incidence, 6, 11, 13, 42, 117, 157.
 - immunity, 9.
 - morphology, 6, 10, 11.
 - pathogenicity, 8, 11, 12.
 - transmission, 10.
 - treatment, 42.
- T. caprae, 5.
- T. cazalboui, 28.
- T. congolense
 - immunity, 16.
 - incidence, 89, 99.
 - treatment, 43.
- T. dimorphon
 - pathogenicity, 83.
 - treatment, 42.
- T. eburneense, 46.
- T. equiperdum
 - diagnosis, 90, 118, 121.
 - incidence, 76, 122.
- T. evansi, 15.
- T. gambiense
 - immunity, 16.
 - incidence, 88, 89, 99.
 - treatment, 42, 43, 44.
 - virulence, 87.

Trypanosomiasis—cont.

- T. grayi, 117.
- T. guist 'hau, 46.
- T. lewisi
 - bionomics, 48, 50, 123.
 - incidence, 28, 46.
 - pathogenicity, 15.
 - transmission, 50.
- T. marocanum, 84.
- T. nanum, 159.
- T. nigeriense
 - identity, 10.
 - incidence, 12.
- T. pecaudi
 - bionomics, 14.
 - incidence, 13, 28.
 - morphology, 14.
- T. pecorum
 - incidence, 13, 117, 160.
 - treatment, 91.
- T. rhodesiense, 44.
- T. simiae, 117.
- T. soudanense, 125.
- var. berbera, 47.
- T. uniforme, 89.
- T. vivax, 13, 99, 159, 160.
- T. wrublewskyi, 88.

INDEX TO RECENT LITERATURE.

The numbers refer to the pages.

Anaplasmosis, 39.	Protozoology, 40, 79.
Babesiasis, 163.	Rabies, 78, 163.
Biting Flies and Ticks, 39, 78, 115, 163.	Spirochaetosis, 115.
Helminths, 39, 79, 116, 164.	Tick Paralysis, 39, 78.
Leishmaniasis, 39, 78, 115, 163.	Trypanosomiasis, 78, 115, 163.
Malaria, 163.	Unclassed, 40, 79, 116, 164.
	Undulant Fever, 78.



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CONTENTS.

TRYPANOSOMIASIS.

	PAGE.
Report No. XVI of the Sleeping Sickness Commission of the Royal Society	117
WATSON : Dourine and the Complement Fixation and Serum Tests	118-121
HAWKE : An Outbreak of Dourine in Canada	122
COLES : Multiplication Forms of <i>T. lewisi</i> in the Rat	123
MAGGIO & ROSENBUSCH : Trypanosomes in Bugs in the Argentine	124
LAVERAN : Trypanosome of Horses in Morocco	125
NUTTALL & HINDLE : The Tryposafrol Treatment of Trypanosomiasis.	125

LEISHMANIASIS.

LAVERAN : The Transmission of Tropical Sore	125
WENYON : Flagellate Forms of <i>L. donovani</i> in a Dog	126
SERGENT, LEMAIRE & SENEVET : Phlebotomus and the Tarentola in regard to Tropical Sore	126
SPAGNOLIO : The Distribution of Leishmaniasis in Man and Dog	127
MACKIE : Leishmania in the Peripheral Blood of Kala Azar	127
WENYON : Leishmania Problems	127

PROTOZOA.

CARINI & MACIEL : <i>Pneumocystis carinii</i>	127
DOBELL & JAMESON : The Chromosome Cycle in Coccidia and Gregarines	128
STEVENSON & WENYON : The Occurrence of <i>Lankesteria culicis</i> in West Africa	129
de MELLO : A New Haemogregarine in Pigeon's Blood	129

HELMINTHS.

SWEET : McEACHRAN & HILL : <i>Onchocerciasis</i> in Cattle in Australia and Other Countries	130-3
LANE : Bursate Nematodes from the Indian Elephant	134
LEIPER : Results of the Bilharzia Mission in Egypt	135
BOUILLIEZ : WATKINS-PITCHFORD : Experimental Investigations on Bilharzia Disease on the Middle Chari and in Natal	139-40
CIUREA : An Echinostome in the Pig's Intestine	140
SKRJABIN : Certain Cestodes of Birds	141
GAIGER : Treatment of Nematode Diseases	141

BITING FLIES.

MacGREGOR : The Rearing of <i>Stegomyia fasciata</i> in London	141
BEQUAERT : The Auchmeromyiae of the Congo	142

EPIZOOTIC LYMPHANGITIS AND SPOROTRICHOSIS.

MEYER : An Account of these Diseases	143
--	-----

RABIES.

PAGE.

AMATO: The Salivary Glands in Rabies	144
FERMI: The Immunising and Antirabic Properties of the Rabic and Normal Tissues of Certain Animals	145
FERMI: The Relative Virulence and Immunising Properties of the Saliva, Salivary Glands and Nervous Tissue	146

MISCELLANEOUS.

MARTOGLIO: The Technique of the Production of Rinderpest Serum	147
THEILER: Investigations into Lamziekte	148
WATSON: Swamp Fever Research	149
WYSSMANN: Pernicious Anaemia of the Horse	149
BURGESS: A Disease in Swine	150
COCA: The Production of Haemolytic Amboceptor against Sheep Corpuscles	151
COOPER & LAWS: The Theory and Practice of Dipping	152

REPORTS.

EGYPT. 1914	153
SOUTHERN RHODESIA. 1914	156-7
TRINIDAD & TOBAGO. 1914-15	159
SOUTHERN PROVINCES, NIGERIA. 1914-15	159
UGANDA. 1914-15	159
NYASALAND. 1914-15	160

BOOK REVIEW.

HOBDAY: Anaesthesia and Narcosis of Animals and Birds	161
RECENT LITERATURE	163

The Title Page and Index will be published with
the first number of Vol. 4.





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