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CONTENTS.

SECTIONS AND SUB-SECTIONS.

	PAGES.
Agalaxy, Contagious, of Goats	209–10
Amoebiasis	1–3
Anaemia, Equine Infections	257–60
Anaplasmosis	3–5, 229–30, 231
Bacterial Diseases	45–6, 117, 187–91, 254–6
Black-Head in Turkeys [Amoebiasis (?)]	85–9
Camel Purgatives	211
Cellulitis, Ulcerative	187–8, 255–6
Coccidiosis	5–6
Dermatitis, Ulcerative	46
Diseases due to	
Filterable Viruses	47–54, 118–32, 191–200, 257–67
Metazoan Parasites	27–37, 105–14, 171–82, 237–53
Protozoan Parasites	1–27, 85–105, 141–71, 221–37
Dysentery, Bacillary	45–6
Filariasis	237 *et sqq.*
Foot-and-Mouth Disease	47–8, 197–200
Haematuria, Bovine	267–9
Haemosporidia, Classification of	231–7
Fowl-Pox	48
Leishmaniasis	89–90, 141–2
Locust Extermination	55–7, 210–11
Lymphangitis	
Epizootic	37–43, 114–17, 182–7
Ulcerative	187–8, 235–6
Malaria, Avian	6
Miscellaneous	55–8, 133, 200–11, 267–80
Mycotic Diseases	37–45, 114–17, 182–7
Nairobi Sheep-Disease	128–32
Piroplasmoses	90–2, 145–8, 230–1, 261
Pleuro-Pneumonia	
Bovine, Contagious	266–7
of Goats	55
Pneumonia, Equine, Septic or Contagious	277–80
Rabies	118–120, 191–5
Recent Literature	77–84, 134–40, 214–20 298–304

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CONTENTS—*cont.*

	PAGES.
Renguera ..	269–77
Reports ..	58–76, 211–13, 280–94
Reviews of Books..	294–7
Rinderpest..	48–52, 120–8, 195–6, 263–6
Septicaemia, Haemorrhagic ..	189–91, 254
Sheep-Pox ..	261–3
Spirochaetosis ..	7–8, 92–6, 142–5
Sporotrichosis ..	43–5
Stomatitis, Contagious Pustular ..	200–9
Sulphur Dips ..	57–8
Trypanosomiases ..	8–24, 96–103, 148–63, 221–9
Tuberculosis in Camels ..	117–18
Variolae ..	53–4, 132
Index of Authors ..	207–9
Index of Subjects..	211–47

ILLUSTRATIONS IN THE TEXT.

Hoggets suffering from Renguera ..	274
Microfilaria	
Schematic Structure of ..	243
Stained by	
Fülleborn's Azur-eosin Method ..	243
Looss's Method ..	242

For CONTENTS, see pages 3 & 4 of Cover

pp. 1-84.] [March, 1917.

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DISEASES DUE TO PROTOZOAN PARASITES.

(a) AMOEBIASIS.

MACFIE (J. W. Scott). **A Case of Amoebic Dysentery in a Monkey.**—*Report of the Accra Laboratory for the Year 1915.* pp. 74–75. With 1 coloured plate comprising 4 figs. 1916. London, W: J. & A. Churchill.

A case of amoebic dysentery is described in a small monkey, *Cercopithecus petaurista*, used for inoculation with a strain of human trypanosome at the Accra Laboratory, West Africa; it died unexpectedly on the 65th day after inoculation, having shown symptoms of diarrhoea for some time, but appearing otherwise healthy.

On post-mortem examination the mucous membrane of large intestine was found to be congested and studded all over with ulcers which were most numerous near the caecum. Each ulcer was roughly circular with a central slough and raised, ragged, blood-stained edges.

In fresh preparations of the contents of the large intestine numerous amoebae were seen. When stained these measured from 12 to 30μ in diameter; the cytoplasm was much vacuolated and contained numerous bacteria-like chromidia. The nucleus was somewhat indistinctly stained by Leishman's method and appeared to possess a fine chromatin network but no distinct karyosome. In sections large numbers of the amoebaè were seen in the bases of the ulcers and penetrating into the adjacent layers of the intestine.

Numerous cysts were also present, measuring, as a rule, 12 to 18μ in diameter, but some larger forms were seen which measured as much as 33μ; these possessed a thick wall, which stained red with Leishman's stain, and a single large vacuole occupying the greater part of the interior; the number of nuclei varied greatly—in some cysts there was only one, but in others there were several. These cysts somewhat resembled the bodies described by ALEXEIEFF (1911) under the name *Blastocystis enterocola.*

The name *Entamoeba cercopitheci* is suggested for the parasite.

Vast numbers of minute spirochaetes averaging 5·28μ in length were also found in smears from the large intestine; these resembled *Spirochaeta eurygyrata* found in human faeces and there was no evidence that they were pathogenic in this case.

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EICHHORN (A.) & GALLAGHER (B.). **Spontaneous Amebic Dysentery in Monkeys.**—*Jl. Infect. Dis.* 1916. Sept. Vol. 19. No. 3. pp. 395–407. With 6 figs.

The outbreak here described occurred in a batch of 15 spider monkeys (*Ateles ater*) kept at the National Zoological Park, Washington, U.S.A., and imported between July and December 1915 from Colombia and Salvador. The monkeys ranged in age from 2 to 5 years and were placed together in a large exhibition cage. One of the monkeys, received on October 26th, showed symptoms of illness on arrival, similar to those manifested later by the others, and it appears probable that this monkey introduced the infection. Eight animals out of the total of 15 exposed succumbed, and of nine showing symptoms only one recovered. While in captivity it was noticed that these spider monkeys had developed a depraved appetite for the faeces which they evacuated. A minute history of the disease in each animal is given.

The symptoms shown were briefly as follows:—Marked dejection, temperature remained practically normal, and appetite, while diminished, was fairly good up to the time of death; loss of weight, but emaciation not marked. The principal symptom was severe diarrhoea, the faeces being usually of a fluid consistency, yellowish grey in colour, and foetid, containing at times a considerable amount of mucus with yellowish flakes; in the more acute cases the faeces were sometimes blood-stained. In several cases the symptoms were apparent for only two or three days before death, while in other cases they lasted for a period of from two to four weeks, the animal at times appearing to have somewhat recovered, and then it would relapse and die suddenly.

On post-mortem examination the caecum and colon were found affected in all eight cases, the rectum being involved to a greater or less degree. No visible lesions could be found in other portions of the gastro-intestinal tract. Abscesses were found in the liver in two cases. The lymphatic glands in the neighbourhood of the colon were sometimes found to be enlarged and oedematous.

The lesions in the large intestine were pronounced and took the form of a dense corrugation and necrosis of the mucous membrane, which in advanced cases was affected nearly throughout. In milder cases the lesions took the form of numerous small ulcers from 1 mm. to 1 cm. in diameter, well separated from each other, and presenting raised, congested, irregular borders. The affected portions of the intestine which had not become ulcerated were covered with a thick, amorphous, diphtheritic material. The deep ulcers penetrated beyond the submucosa, but no indication of the condition in the lumen of the intestine was apparent from the peritoneal surface.

Abscesses of the liver were found in the two cases showing most extensive intestinal lesions; in one case, only one abscess was present, while in the other case five fairly large abscesses and two smaller ones were observed.

A detailed account is given of the lesions involving the intestines and the liver in each animal.

No special attempt was made to determine the species of the amoebae. The amoeboid forms were especially numerous in the liver abscesses, but could also be readily found in intestinal matter, the encysted forms being more numerous in the latter. In the vegetative stage they showed very active protoplasmic changes when taken fresh from the pus of liver abscesses or from faecal material.

To determine the relationship of the causal organism of this disease, named *Amoeba ateles* by the authors, to the tropical dysentery of man an attempt was made to transmit the disease to cats, since these animals are susceptible to *Amoeba histolytica*. Feeding experiments on four cats gave negative results, suggesting that the parasite belonged to a different species from that of man. It is stated, however, that the results do not warrant any conclusions as to the pathogenicity of this parasite in cats, since failure of transmission to a limited number of animals is not sufficient evidence as various investigators have found that the transmission of human amoebic dysentery to cats is not invariably successful.

(b) ANAPLASMOSIS.

FINZI (G.) & CAMPUS (A.). **Anaplasmosi. Sul significato dei "Corpi Endoglobulari" "Punti Marginali" "Anaplasmi", trovati nel sangue degli ovini della Sardegna e del Piemonte.** [Anaplasmosis. The Significance of "Intra-corpuscular Bodies," "Marginal Points," "Anaplasms" found in the Blood of Sheep from Sardinia and Piedmont.]—*Nuovo Ercolani.*, 1916. Oct. 31–Nov. 10, Dec. 10–20, and 1917 Jan. 15–31. Vols. 21 & 22. Nos. 30–31, 34–35, and 1–2 respectively. pp. 493–500, 557–571, and 2–8 respectively.

The greater part of this article is concerned with an exhaustive survey of the literature dealing with the subject of anaplasms since they were first incriminated by THEILER in 1908 as the cause of the so-called "gall-sickness" of cattle in South Africa. Various authors have since found these bodies in the blood of cattle suffering from diseases clinically resembling gall-sickness in widely separated parts of the world.

A description of the morphology and incidence of anaplasms in the blood is given. Numerous observers have recently discovered similar structures in the blood of other species of animals, particularly in animals suffering from diseases characterised by grave anaemia; considerable doubt has thus been shed on the specificity of anaplasms, many observers holding that they are merely artefacts, forms of degeneration accompanying anaemia, or remains of other blood parasites. The views of authors who have attempted to disprove the parasitic nature of the structures are very fully entered into.

The observations made by Finzi and Campus were limited to a few sheep imported for experimental purposes from Sardinia.

"Tibaldi (1914), considering that in Sardinia—on account of its geographical position, frequent inter-communication with the coast of Africa, and the great abundance of Ixodidae and other arthropods—haemoparasitic protozoa could not be lacking examined numerous smears prepared from the blood of various Sardinian animals, and he found, in fact, after methodical researches, forms of anaplasms in the dog, pig, horse, sheep, and guinea-pig."

One of the imported sheep kept under the authors' observation, after a few months, developed acute symptoms of liver-fluke disease. On examination of blood smears a large number of red blood corpuscles were found to contain in the centre, but more frequently at the periphery, coccus-shaped bodies, which took on an intense chromatin tint, and were considered to be absolutely identical with the protozoan structures named by authors " marginal points " or " anaplasms."

On examining the blood of the remaining six sheep it was found that in the case of two of them the red blood corpuscles were invaded with similar bodies to the extent of 30 per cent. These two sheep showed manifestations of anaemia and the eggs of the liver fluke were found in their faeces. The sheep showing these structures were obviously suffering from fluke disease.

Examination of blood from sheep in two districts in Italy was then undertaken and in some of these sheep bodies similar to anaplasms were discovered, but it had to be admitted that these sheep were also suffering from fluke disease.

The authors endeavoured to elucidate the problem as to the nature of these structures by provoking experimental anaemia in sheep and rabbits. Some of the rabbits were deprived of their spleens as one of the authors (Finzi) had previously demonstrated the destructive power of the spleen on haemoglobin. Some of the animals were inoculated with a large quantity of distilled water and others with a specific anti-red-corpuscle serum. Smears were made from the blood at varying intervals.

The usual anaemia changes in the red blood corpuscles were seen and a large number of the corpuscles were alleged to contain bodies similar to marginal points.

The authors' conclusions are as follows :—

" (1) The observations made by Tibaldi in Sardinia and our own observations do not allow of our affirming the existence of anaplasmosis in Sardinian sheep.

" (2) It is easily proved that ' marginal and central points ' can be found also in the red blood corpuscles of Piedmontese sheep.

" (3) The marginal and central structures are not always the real and true parasites.

" (4) The intracorpuscular marginal and central bodies are frequently signs of changes of the blood commonly observed in the anaemic state.

" (5) Acute secondary anaemia following grave distomatiasis gives rise, in the sheep, to the possible appearance within the red blood corpuscles of certain round corpuscles, coccus-shaped, 0·1 to 0·5 microns in diameter, placed either at the periphery or centre of the corpuscle.

" (6) The anaemia following the injection of specific haemolytic sera into sheep also produced changes in the corpuscles represented by the appearance of dots and of central and peripheral granules.

" (7) The anaemia following the injection of distilled water shows, in normal rabbits and in rabbits deprived of their spleens, changes in the blood exactly comparable to those observed in sheep affected with anaemia produced experimentally by specific haemolytic serum.

" (8) The results of our experiments fully confirm the conclusions arrived at by Dias and Aragao and by Laveran and Franchini.

" (9) Although convinced that not all the forms of disease described as anaplasmosis are real and true diseases due to a specific protozoan, and that the ' intracorpuscular bodies ' or ' marginal points ' may have much less significance than some authors have thought fit to attribute to them, nevertheless the observations of Theiler and Lignières — and more especially those of the latter author—require that anaplasmosis should be considered amongst the protozoan diseases due to parasites of a special type which should be considered as a separate and distinct on its own account and as a clearly defined morbid entity."

[The object of these authors' experiments cannot be understood as the anaemia provoked by their methods would naturally have been expected to give rise to the well-known changes in the corpuscles known as punctate degeneration. Moreover, the authors do not seem to have taken into account the clinical nature of the disease, the descriptions of the South African gall-sickness not corresponding in any way with the disease described in their sheep.

As regards the confusion between gall-sickness or anaplasmosis and ordinary redwater it appears that these diseases can be easily distinguished experimentally, for when blood containing the causal organisms of both diseases is inoculated into a susceptible animal the reaction set up by the one disease takes place much later than in the case of the other.—Ed.]

(c) Coccidiosis.

Guillebeau (A.). **Parasitisches Vorkommen von** ***Eimeria Stiedae*** **(Lindemann) in der Leber des Hundes.**—[*Eimeria stiedae* Lindemann in the Dog's Liver.]—*Schweiz. Arch. Tierheilk.* **1916.** Nov. Vol. 58. No. 11. pp. 596–602. With 6 text figs.

Coccidiosis of the liver, although common in rabbits, is very rarely found in the pig (Johne), and in the dog (Rivolta, Perroncito). Bornhauser (1912) described the occurrence of coccidia in the epithelium lining the bile duct and in the liver parenchyma of the dog; these parasites were much larger than those found by the author, and belonged to the so-called *Diplospora* (or *Isospora*) *bigemina*.

The two cases described by the author occurred in old dogs (10 and 13 years old, respectively,) in which the most marked symptom during life was great enlargement of the abdominal cavity.

On post-mortem examination this was found to be caused by the presence of a large quantity of blood-stained exudate. The spleens were enlarged. The liver was also increased in size and distorted in appearance. In one case numerous soft dark red centres ½ to 1 cm. in diameter could be seen on the surface of the liver and in both cases these were found to be numerous in the parenchyma.

Microscopic examination of scrapings from these nodules showed the presence of red blood corpuscles among which were found a large number of small parasites, uniform in shape, measuring 7 by 12μ, containing a nucleus 3μ in diameter. This nucleus underwent changes after exposure to the air for a day. These parasites are smaller than those found in rabbit coccidiosis, in which the parasites, as a rule, measure from 20 to 50μ in length by $20–39\mu$ broad.

Histology.—The less advanced lesions were found to be composed of a network formed of trabeculae of liver cells and filled with red blood corpuscles. The liver cells were nucleated and contained a granular protoplasm in which were found rounded lightly-staining parasites 1μ in diameter containing a small point which stained deeply with haematoxylin. These parasites were considered to be the schizonts of coccidia.

In the more advanced lesions distension of the blood vessels becomes more and more marked while the liver trabeculae become shrunk down to 20 or even 4μ in thickness, and covered at a distance of 4μ on either side by a membrane about 2μ in thickness corresponding to the walls of the intralobular capillaries. The trabeculae finally disappear completely until in places the section is composed almost entirely of red blood corpuscles, among which are found numerous coccidian zygotes.

(d) Bird Malaria.

Brug (S. L.). **Morphologische Studien an** *Proteosoma praecox.* [Morphological Studies on *Proteosoma praecox.*]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1916. July. Vol. 20. No. 13. pp. 289–306. With 2 coloured plates, comprising 104 figs.

These studies were undertaken with the object of determining whether certain forms could be seen which had caused Hartmann to classify Proteosoma among the Binucleata.

The material was obtained from the blood of canaries infected with Proteosoma. The best preparations were obtained after drying and fixing with alcohol, and staining with Giemsa for three to four hours. Good results were also obtained by using Kiewiet de Jonges stain consisting of Azur II 40 mg., eosin 25 mg., methyl alcohol 25 cc. This stain was placed on the unfixed smear, an equal quantity of distilled water added immediately, and then allowed to stand for from one-half to one hour. Other methods of fixation and staining are also described, but the results obtained were not good.

The various stages in the life-cycle of the parasite are very well depicted in the coloured plates.

In order to study the development of the microgametes the slide covered with the fresh blood film was placed for from 10 to 75 minutes in a moist chamber consisting of a Petri dish containing some moist blotting paper, and then dried and stained with Giemsa. Better preparations are obtained in this way than when blood is taken from the stomach of flies, as in the latter case it soon coagulates and poor smears can only be obtained. The author dwells at some length on the analogy which some authors have thought to exist between the microgametes and the trypanosomes.

The conclusions are as follows :—

"(1) In the life-cycle of Proteosoma there occurs a stage in which these organisms appear bi-nucleated, recalling somewhat the same characters of certain flagellates. In young schizonts there is often seen an accessory nucleus which divides by amitotic division.

"(2) The half or fully grown schizonts, the sexual forms, the ookinetes, show no accessory nucleus (blepharoblasts).

"(3) Although the bi-nucleated character of the young schizonts can be brought forward in order to indicate the resemblance between the Proteosoma and Trypanosomidae the differences between them are too great to enable one to classify them in the same order. (It is always questionable whether there exists a sexual stage in the Trypanosomidae, etc.).

"(4) The gametes in the peripheral blood in cases of experimental infection of canaries with Proteosoma by means of blood inoculation often appear at the same time as the schizonts. Their appearance is not consequent upon commencing immunisation.

"(5) The microgametes are built out of a chromatin net found towards the periphery of the microgametocytes. Certain forms can be found among these which can be mistaken more or less easily for the structure of a trypanosome.

"(6) Reduction bodies are extruded in the process of maturation of the macrogametocytes."

(e) Spirochaetosis.

Bekensky (P.). **Contribution à l'étude des spirochètes des voies digestives des porcs dans leurs rapports avec la peste porcine.** [The Relation between the Intestinal Spirochaetes of Pigs and Swine Fever.]—*Rec. Méd. Vét.* 1916. Oct. 15. Vol. 92. No. 19. pp. 545–552.

In this preliminary communication from the veterinary laboratory of the Ministry of the Interior at Petrograd, the author first brings under review the works of various investigators who have of late years discovered spirochaetes in the blood, intestines, and cutaneous lesions of pigs affected with swine fever. Reference is made to the publications of Smith (1894), Siegel, Dodd, Poenaru (1906), Cleland, Gilruth, and Ruther.

The works of the American authors, King, Hoffman, Drake, and Baslack are also reviewed at some length. These authors, in a series of articles, claim to have discovered short rare spirochaetes in the blood of swine fever affected pigs, and also somewhat longer ones in scrapings from intestinal ulcers, the mucus covering the caecal ulcers, and towards the ileo-caecal valve, as well as in the external lesions of affected pigs. These organisms could not be discovered in the other organs and tissues. In recovered pigs the spirochaetes were observed to disappear. These investigators thus concluded that in the mucus covering the caecum of healthy pigs there exist a number of large non-pathogenic spirochaetes; in the ulcers of the caecum and along the ileo-caecal valve of swine fever affected pigs one nearly always finds spirochaetes of a special kind which play a part in the evolution of swine fever. They are further of opinion that the morphological differences between the spirochaetes found in the blood and in the ulcers and local lesions of affected pigs might arise on account of the influence of the blood as a medium on the spirochaetes, or on account of the natural evolution of the organisms.

Arnheim, critisising the conclusions of the preceding authors found that salvarsan, which is toxic for spirochaetes, has no influence on swine fever, and also he was able to find spirochaetes in the blood of affected pigs only on one occasion.

Bekensky thus, from a study of the literature, concludes that there is no agreement on the question of the relationship between the intestinal spirochaetes and swine fever.

The question was studied by him on the carcases of pigs sent to the laboratory for diagnosis, the caeca and recta of healthy pigs collected at the Municipal Abbatoir at Petrograd, live healthy pigs hyper-immunised against swine fever, pigs among which outbreaks of swine fever had occurred, and, finally, pigs among which anthrax had broken out. A very thorough examination for the presence of spirochaetes was made on these animals.

After a considerable number of failures mixed cultures of spirochaetes were obtained for use in experiments on sucking pigs.

Detailed measurements of the spirochaetes, including length, number of spirals, length and amplitude of the spirals, were also taken.

The author concludes as follows:—

"In the examination of pigs affected with swine fever, spirochaetes were discovered in a large number of cases, but not always (58·7 per cent.).

It was brought out that spirochaetes could be found in the case of pigs living in establishments where swine fever existed (17 per cent.), and on the contrary when pigs were affected with swine erysipelas or with anthrax spirochaetes were not once found.

"In the case of sucking pigs artificially infected with the ultra-visible virus, spirochaetes were discovered in nearly all cases (17 out of 19).

"In the case of pigs inoculated and drenched with mixed cultures of spirochaetes and in pigs placed in contact with these animals spirochaetes were discovered in all cases (7), but one must bear in mind that at the same time in these experiments the typical picture of swine fever was not obtainable. *These facts seem to point out that in pigs suffering from swine fever the spirochaetes found in the intestinal tract play a certain etiological role, in the same manner as the other micro-organisms which provoke a secondary infection, the fundamental disease being due to the ultra-visible virus.* Moreover, in the case of hyper-immunised pigs in the bodies of which one would suspect the presence of swine fever antibodies spirochaetes were not discovered on any occasion. The fact that spirochaetes have been found in healthy pigs in establishments perfectly free from swine fever does not contradict this statement; the experiments of UHLENHUTH, GABBERT, and others on *B. suipestifer*, and the experiments of SMITH, MOORE, BANG, JENSEN, KARLINSKI, KITT, KLEIN, and others on *B. suisepticus*, show that agents of secondary infection are encountered in the bodies of healthy animals. The frequency of spirochaetes in healthy pigs varies from 7 to 12 per cent.

"*On one hand*, it is admissible that on account of the lowered resistance of the body and the influence of the ultra-visible virus the spirochaetes of the digestive tract, like other saprophytes present in the bodies of pigs and harmless for a certain time, acquire a greater power of reproduction and perhaps of pathogenicity on the pig's body in general, and especially in the direction of producing morbid lesions in the digestive tract.

"*The other side* of the question is by no means clear. Are the spirochaetes found in the digestive tract of pigs capable of producing a general infection or only a local action? Moreover, the work of observers who have found spirochaetes in the blood and cutaneous lesions of affected pigs does not exclude the probability that the spirochaetes found in the digestive tract of pigs are capable of passing into the blood by way of the lymphatics, and are thus the determining agents of swine fever. The fact that spirochaetes have not been discovered by us in the blood gives no reason for denying categorically the probability of this supposition, but it might indicate that the spirochaetes found in the blood are at a stage of their development in which their discovery would be very difficult.

"In conclusion, it is necessary to note that the spirochaetes found by us in the digestive tract of pigs, viz., spirochaetes with large and spirochaetes with small spiral wave lengths were found together in every part of the digestive tract—in the case of healthy animals, as well as in pigs affected with swine fever."

(f) TRYPANOSOMIASES.

LAVERAN (A.). **Surra, nagana ferox, nagana de l'Ouganda et infections due au *Trypanosoma rhodesiense*.** [Surra, Nagana Ferox, Uganda Nagana, and Infections due to *T. rhodesiense*.]—*Bull. Soc. Path. Exot.* 1916. Nov. Vol. 9. No. 9. pp. 731–738.

Differences of opinion have arisen among authors as to the relations existing between *T. brucei* and *T. rhodesiense*, and as to the unicity or plurality of the trypanosomiases described under the name of nagana. BRUCE and his collaborators, as the result of their researches, based principally on measurements, concluded that the above two trypanosomes were identical. The author in 1912 published the results of some cross-immunity tests which demonstrated that they were not identical. The biometrical method has been shown by DUKE, SCHILLING, and SCHRECK to be liable to give rise to errors.

It appears that animal trypanosomiases of different natures have been confounded under the name of nagana. The work of STEPHENS and BLACKLOCK shows that the parasite of Zululand nagana is a monomorphic trypanosome, whilst that of Uganda nagana is of the dimorphic type, and thus these trypanosomes cannot be identical. The name *T. ugandae* was given by them to the latter trypanosome. MESNIL'S cross-immunity tests also showed that these two types were different. Authors are agreed that Zululand nagana is quite distinct from surra. The identity of Zululand nagana and Uganda nagana being disputed, the author thought it would be interesting to find out whether goats immunised against Mauritius surra remained susceptible to Uganda nagana.

Five goats and one sheep were used in his experiments and the following viruses were employed: the Mauritius surra virus kept in the author's laboratory; the virus of nagana ferox from EHRLICH'S laboratory, maintained for several years in the author's laboratory; the virus of Uganda nagana obtained from BRUCE and kept in the author's or in MESNIL'S laboratory; and *T. rhodesiense* from the Runcorn Research Laboratory, Liverpool, kept for five years in the author's laboratory. A detailed account of each animal during the course of these experiments is given. The following is a résumé of the observations:—

Goat 1.—A clean goat, inoculated with Uganda virus, became infected, and died at the end of 66 days.

Goats 2 *&* 3.—These goats, immunised against surra, were inoculated with the Uganda virus, became infected and died, the first in 96 days, the second in 52 days.

In these three animals the infection produced by the Uganda virus was characterised by fever, wasting, and nervous symptoms during the last phase of the disease, consisting in paresis of the hind quarters, trembling, ataxic movements and convulsions; in the three cases the disease was fatal.

Goat 4.—Inoculated on the 10th September 1914 with Uganda nagana, became infected, and in the month of June 1915 it had acquired immunity against this trypanosomiasis. Inoculated on the 14th September 1915 with *T. rhodesiense* it became infected; in the month of June 1916 it had recovered and possessed immunity against this trypanosome; after inoculation on the 23rd August 1916 with the virus of nagana ferox it did not become infected.

Goat 5.—Inoculated with nagana ferox on the 6th April 1915, became infected, and in the month of September 1915 it was immune against this trypanosomiasis. After inoculation on the 22nd January 1916 with the virus of Uganda nagana on two separate occasions the goat did not become infected. After inoculation on the 16th August 1916 with *T. rhodesiense* it became infected.

The *sheep*, which had acquired, in August 1914, a strong immunity against nagana ferox, and was inoculated on the 13th November 1914 with the virus of Uganda nagana, became infected and died.

The following conclusions are drawn from these results:—

"(1) Goats 2 and 3, immune against Mauritius surra became infected with the virus of Uganda nagana in the same manner as the clean goat 1, and the disease presented the same degree of severity in the case of all three animals; Uganda nagana thus has no relationship with surra.

"Goat 4 immune against Uganda nagana, and Goat 5 immune against nagana ferox and Uganda nagana, when later inoculated with *T. rhodesiense* became infected; it thus results that the viruses of nagana ferox and Uganda nagana have no connection with *T. rhodesiense.*

"Goat 4, having acquired immunity against Uganda nagana and *T. rhodesiense,* did not become infected after inoculation with nagana ferox; the same applied to Goat 5, immune against nagana ferox and, inoculated twice with the virus of Uganda nagana, did not become infected; but, the sheep immune against nagana ferox was shown to be as susceptible as a clean animal to Uganda nagana.

"These last facts, which seem contradictory, can be explained if one admits that Uganda nagana and nagana ferox are varieties of the same species, one of the varieties having been able to acquire a higher degree of virulence than the other. I have not observed between the trypanosome of nagana ferox and that of Uganda morphological differences pronounced enough to exclude this hypothesis."

MESNIL, in discussing this paper, notes that in Laveran's experiments the sheep immune against nagana ferox, which seems to be only a laboratory variety of Zululand nagana, was as susceptible as a control animal to Uganda nagana. He also believes, however, in the specific identity of the viruses on account of the results obtained from the cross-immunity tests on goats.

Another point raised was that nagana ferox, or the laboratory Zululand nagana, consists of monomorphic trypanosomes. However, the Uganda nagana virus as seen by BRUCE and his collaborators in the country it originated from—like that of Zululand nagana when introduced into Europe in 1896—was polymorphic, and was still so when STEPHENS and BLACKLOCK studied it and sent it to him (MESNIL) in 1911, but in 1913 he already noted that it was in the process of losing its short and stumpy forms. Laveran now notes that it scarcely differs morphologically from nagana ferox. The nagana virus as well as *T. gambiense* and doubtlessly other viruses of the same group, from being naturally polymorphic, become monomorphic in laboratories.

VAN SACEGHEM stated that in the Belgian Congo the *brucei* virus obtained from Zululand was polymorphic and that its polymorphism was maintained in equines, bovines, goats, sheep, rabbits, and guinea-pigs. On the other hand, in the white rat he only obtained intermediate forms of the trypanosome.

MITZMAIN (M. B.). **Collected Studies on the Insect Transmission of** *Trypanosoma Evansi.—Treasury Department. United States Public Health Service. Hygienic Laboratory Bulletin* No. 94. 1914. June. pp. 7–39. With 5 plates comprising 10 figs. Washington: Government Printing Office.

In these studies the author undertook to ascertain the possible rôle in the transmission of surra of all the common flies found on horses and other susceptible animals in the Philippine Islands.

(1) *The Relation of* Tabanus striatus *to Surra Dissemination.*

An interesting account of the literature dealing with the association of the Tabanidae with animal trypanosome transmission is given. Reference is thus made to the work of ROGERS (1901) with surra in India, FRASER and SYMONDS (1908) with surra in the Federated Malay States, Ed. and Et. SERGENT (1905–1906) with the trypanosomiases encountered in Algeria, BRUCE and his collaborators (1910) with African cattle trypanosomiasis (*Trypanosoma pecorum*), LEESE (1911–1912) and BALDREY (1911) with surra in India, and MOHLER and THOMPSON (1909) with surra in imported Indian cattle.

In a previous series of experiments the author endeavoured to determine to what extent *Tabanus striatus* Fabricius, the common house (horse ?) fly of the Philippines, was involved as a mechanical carrier of trypanosomes. It was noted that in these experiments a very small percentage of positive results (3 out of 16 attempts) was obtained; it was concluded that the feeding methods employed restricted the normal behaviour of the flies, for, after the single insertion of the proboscis into the infected animal, the flies were noticed to complete their meal upon the healthy host. In nature the feeding is differently conducted as it was observed that owing to the irritability of the host a fly always required several insertions of its proboscis at short intervals into different hosts.

Two experiments in which the more natural behaviour of the gadfly was simulated resulted successfully, both animals, a horse and a bull, showing undisputable evidence of the disease.

In previous experiments trials with single flies resulted negatively when the fly was permitted to bite infected and healthy animals once only. An experiment was carried out in which a tabanid was induced to feed with the maximum number of interruptions, on two hosts alternately, with only a few seconds interval between the bites. The infected and healthy horse were thus each bitten 26 times. The healthy horse after an incubation period of 9 days presented symptoms and died 67 days later. The experiment was also successful when repeated on monkeys.

The length of time *Tabanus striatus* remains infective was determined by feeding a number of flies on an infected animal and transferring them on to susceptible animals at intervals varying from three minutes up to between three and four hours. It was found that 15 minutes is the maximum time during which the fly is able to infect through its biting.

In order to test the indirect method of infection, the author succeeded in keeping a limited number of flies alive under artificial conditions for 26 days in the case of two experiments and 21 days in the case of one experiment. After the initial engorgement on a surra-infected horse the flies were applied at intervals varying from one to two days up to 24–26 days upon susceptible horses. The results were entirely negative. The bodies of the dead flies, when inoculated into guinea-pigs and a horse during this period, did not produce surra.

The problem as to how many horses flies could infect successively was determined by exposing three horses, screened from each other, to the bites of flies which had contaminated their labia by biting a horse whose blood was swarming with trypanosomes. Forty-three flies thus fed on the sick horse, 43 on the first contact horse, 39 on the second contact horse, and 32 bites were completed on the third contact. After an incubation period of six days the first contact horse showed a rise of temperature together with trypanosomes in its blood and died on the 62nd day. The second and third contact horses remained healthy and no trypanosomes could be discovered in their blood either by microscopic examination or by inoculation into monkeys and guinea-pigs. This shows that the bite of *Tabanus striatus* is incapable of infecting more than one horse as the result of a previous contamination.

The author next describes an outbreak of surra on the Government stock farm near Manila which, from a study of the topography of the district and the conditions in which the animals were placed, pointed to *Tabanus striatus* as being the most probable carrier of infection. Stallions kept in darkened stables did not contract the disease; daily examinations of their quarters showed an absence of gadflies, although the stable inhabiting species, *Hippobosca maculata* and *Stomoxys calcitrans*, in addition to several species of mosquitoes were encountered.

From an exhaustive study of the breeding places of the gadfly, *Tabanus striatus*, in Southern Luzon the author found that the distribution of the fly coincided exactly with the places where very serious outbreaks of surra occurred.

Many investigators have observed that Tabanidae do not infest animals kept in a darkened stable. The author refers to the observations of SCHAT (1903) in Java, LAVERAN and MESNIL (1907) on an outbreak of surra in cattle in Mauritius, and LEESE on the influence of dark stables in India in preventing the spread of surra.

An observation is recorded in which a horse infected with surra was allowed to remain in an open shed with eleven other horses and four bulls. Many stable flies and Hippoboscids were seen, but gadflies were not in evidence. None of the in-contact animals became infected.

The protection afforded by darkened stables was also shown during a trial in which three horses and two carabaos were placed in a partially darkened shed where three surra-infected carabaos in contiguous stalls were exposed to biting flies during the season of maximum tabanid infestation. The eight animals were not disturbed for a period of two months. Culicoides, Phlebotomus, and various species of mosquitoes were observed in addition to stable flies and Lyperosia. During the entire period two specimens only of *Tabanus striatus* were collected, although in the adjoining pastures they were extremely numerous. The five healthy animals remained uninfected as the result of the experiment.

(2) *The Relation of Mosquitoes to Surra.*

LEESE in particular among the authors quoted considered that he had satisfactorily eliminated Anopheles, Culex, and Stegomyia in several surra transmission experiments performed in India. In a large series of experiments with surra in the Philippines the author himself was not able to transmit the infection with several species of mosquitoes. Details of experiments are tabulated in which two species, viz., *Aedes (Stegomyia) calopus* and *Culex fatigans* are considered in relation to various hosts in the direct method of infection. Negative results only were obtained in all (seven) experiments.

In an experiment, the larvae were reared from the eggs of 300 specimens of the first of these two species of mosquitoes, fed previous to laying their eggs on an infected horse; these larvae were then applied to a healthy horse, with negative results; the matter of hereditary transmission was thus disposed of as well as transmission by the indirect method.

Mosquitoes were found to harbour surra trypanosomes for a greater length of time than any other blood-sucking insects. Several specimens of *Aedes (Stegomyia) calopus* were found to contain active trypanosomes in the proventriculus for a period of 42 hours after the infective bite. No trypanosomes were found in the salivary glands or in the mouth parts during various periods up to 36 days. Thirty hours was the longest period the trypanosomes were found to be virulent by inoculation.

The author next describes a field experiment in which healthy horses were exposed by night to infection by contact with infected horses. The exposed horses were removed during the day-time in order to eliminate *Tabanus striatus* as a transmitting agent. None of the exposed horses became infected.

(3) *Notes on the Bionomics of* Lyperosia exigua *and the Relation of this Fly to Experimental Trypanosomiasis.*

This fly is the most common of all the species of blood-sucking flies on draught animals in the Philippine Islands. It is prevalent during all seasons and during all hours and is usually at rest on bovines at night, accompanying mosquitoes and sandflies. It is rarely found on horses. A detailed account of the life-cycle, which lasts on an average 9–11 days, is given. The probability of this fly acting as a mechanical transmitter has been mentioned by SCHAT, LEESE, and AUSTEN. In experimenting with this fly three methods of procedure were adopted, viz. :—(1) Exposing healthy animals and infected animals to the bites of flies under natural conditions. Here counts were made of flies taken in the act of biting the hosts kept in the open ; (2) the experimental animals were exposed in a screened stable to the biting of a specified number of flies collected from known sources ; (3) bred flies were applied from test tubes upon infected and healthy animals at stated intervals. The author's own summary of the results of these experiments is as follows :—

"Experiments in the direct method with *Lyperosia exigua* and *Trypanosoma evansi* gave negative results.

"Horses, which were exposed under natural conditions to the biting of flies infesting sick carabaos, did not become infected.

"When thousands of flies infested sick and healthy carabaos placed in a large screened inclosure no infection was transferred.

"Only negative results were obtained in the interrupted method of feeding flies in 13 experiments with various animals. In six trials there was no appreciable interval between the bites of flies removed from the infected hosts, and in seven experiments intervals occurred varying from 5 hours to 10 days. The greatest number of flies employed was 61.

"In one experiment with several thousands of flies the possibility of transmission of *Tr. evansi* hereditarily was eliminated."

(4) *Mechanical Transmission Experiments with* Philaematomyia crassirostris.

This species of fly is as numerous as the ubiquitous stable fly especially during the months of April and May. It has previously been described in India and Africa and is noted for its peculiar mouth apparatus which, at first sight, would appear to belong to a non-blood-sucking form. It preferably infests cattle.

Experiments in the direct method of transmission proved unsuccessful at intervals of less than one minute, an hour, and 24 hours. One experiment only proved successful ; a monkey became infected as the result of six successive daily applications of numerous fresh flies which had just previously fed on an infected monkey.

(5) *Experiments with* Hippobosca maculata *in the Transmission of Surra.*

This fly is found upon all draught animals, especially on horses, during the whole year and it seems to attack equally well in darkened stables and in open pastures. As a rule it prefers to finish its protracted meal upon the same host. Twelve experiments in the direct method of feeding were pursued, using guinea-pigs for the most part; entirely negative results were obtained. A number of flies were next fed on an infected animal and applied to clean animals every day up to the 26th day, when there were only two survivors out of the original 33. Negative results again were obtained.

(6) *Experiments with Blood-sucking Gnats.*

Experiments with *Culicoides judicaudus*, in which some hundreds of flies were employed, both in direct and indirect transmission experiments, gave negative results.

Observations on a very common species of *Phlebotomus* likewise showed that this insect was incapable of transferring surra from infected to healthy animals.

(7) *The Role of* Musca domestica *in Surra Conveyance.*

The intimate relations existing between the feeding habits of *Stomoxys calcitrans* and the common house fly had been previously noted by the author. It was pointed out that the house fly acted in a sense as a secondary passive parasite by lapping to a point of engorgement the blood brought to the host's epidermis by the probing of the labium of the stable fly. It was first proved by means of numerous dissections and inoculation of saline suspensions of the abdominal contents into susceptible animals that *Musca domestica* could harbour infective organisms.

Attempts were made to simulate natural conditions by feeding large numbers of house flies on the blood of an infected animal and then allowing them to feed in conjunction with an equal number of clean Stomoxys on the tail of a clean monkey. The house flies then applied their mouth parts to the punctures made by the stable flies. Five experiments made after this manner gave negative results.

The possibility of surra infection being carried by the fly's feet was tested by repeating the preceding experiment, but in this case the flies were prevented from feeding and were only allowed to alight on the tail. Five experiments made in this way also failed to show that the wound made by the labium of the stable fly was a suitable channel for the introduction of trypanosomes.

It was further shown that the bites of the stable fly were not suitable sites for the introduction of trypanosomes by smearing fresh infective blood on a part that had just been bitten by Stomoxys.

House flies that had engorged on blood obtained from the bites of stable flies on infected animals were next allowed to feed on the abraded surface of the skin of three monkeys and two horses. It was found that positive results were obtained in four cases out of five.

NOELLER (W.). **Die Uebertragung des *Trypanosoma theileri*, Laveran, 1902.** [The Transmission of *Trypanosoma theileri* Laveran, 1902.]—*Berlin. Tierärztl. Woch.* 1916. Sept. 28. Vol. 32. No. 39. pp. 457–460. [Reprinted from the *Rev. Applied Entom.* 1917. Jan. Vol. 5. Ser. B. No. 1. p. 11.]

"The innocuous and easily bred *Trypanosoma theileri* probably occurs wherever domestic cattle are found and also among wild ruminants, such as antelopes. Its various forms have received different names. Knuth and Rauchbaar found flagellates in German TABANIDAE (*Tabanus* sp. ? and *Haematopota pluvialis*, L.), but could not prove their connection with this trypanosome. In 1903 Theiler considered the transmission of *T. theileri* to have been effected in South Africa by the Hippoboscids, *Hippobosca rufipes*, Olf., and *H. maculata*, Leach, but this cannot be held to be conclusive, as the possibility of transmission by other carriers, such as Tabanids and *Stomoxys* was not excluded. The scarcity of Hippoboscids on German cattle show that these flies cannot play an important rôle. It is far more probable that Tabanids are involved, as they harbour many flagellates. From available data the following list of Tabanids in which flagellates have been recorded has been compiled:—*Tabanus tergestinus* and *T. glaucopis* in southern France; *T. socius*, *T. par*, *T. ditaeniatus*, *T. fasciatus*, *T. africanus*, *T. gratus* and *T. virgatus* in Egypt; *T. hilarius* and *Tabanus* sp. in India; *T. secedens* and *T. thoracinus* in East Africa; *T. testaceomaculatus* in Chili; *T. congolensis* and *T. taeniola* in the Island of Principe. To these the author adds *T. bovinus* in Poland, and *T. bromius* in Brandenburg. Other records include *Pangonia infusca* and *P. neavei* in the Congo; *P. australis* in Chili; *Haematopota italica* in southern France; *H. pluvialis* in Germany; *H. duttoni* and *H. vandenbrandeni* in the Congo. All those observers of Tabanid flagellates who have studied the site where the flagellates occur in the bodies of the flies state this to be the walls of the hind-gut, though Bruce occasionally observed them in the fore-gut. The author's observations only relate to flagellates attached to the hind-gut, and the dissected Tabanids showed none in their stomachs, indicating that the infections were not recent ones. All observations relate to flagellates from the blood-sucking females, which attack cattle and horses by preference. Only a small percentage of these females are infected, and in wet, cold years the infection is absent in localities where it had previously occurred. In cattle-breeding districts the flagellates are common in Tabanids during hot summers. These observations pointed to a connection between the Tabanid flagellates and *T. theileri*. Among the ways in which the exact experimental proof of such connection could be reached was the one provided by the size and the characteristic shape of the giant culture forms of *T. theileri*. A full account is given of the experiment, which proved that the flagellates from *Tabanus glaucopis*, Meig., are the developmental stage of *T. theileri*. It is thought probable that other Tabanid flagellates also represent the developmental stage of this trypanosome. This experiment further proves that the transmission is not a simple mechanical one. A bibliography of 14 works closes this paper."

BOUET (G.). **Contribution à l'étude des zones à glossines du Sénégal (Région du chemin de fer de Thiès à Kayes).** [The Tsetse-Fly Belts of Senegal (Area traversed by the Thies-Kayes Railway Line).]—*Bull. Soc. Path. Exot.* 1916. Dec. Vol. 9. No. 10. pp. 802–813. With 1 map.

This paper forms an interesting contribution to the study of the fly belts and trypanosomiases of West Africa, the district particularly dealt with being that traversed by the projected railway connecting Senegal with the Sudan. This railway is about 700 kilometres in length between Thies, near the western coast of Africa, and Kayes on the Senegal River, and the first 400 kilometres are already under construction.

The intensive cultivation of earth-nuts has led to the gradual clearing of the first 300 kilometres but beyond the cultivated areas there exists a dense vegetation of trees and shrubs. The vegetation varies somewhat as the railway line penetrates into the interior of the country, becoming rather rare as it passes along the border of the Ferlo desert; then again afterwards up to the Falémé stream, at the 575th kilometre, the vegetation becomes thicker containing new species, especially bamboos. The railway tract is in no part crossed by a permanent watercourse.

Although the conditions of the country through which the railway passes seem everywhere favourable to the existence of *Glossina morsitans*, yet this fly is only found between the 440th and 575th kilometre. The railway runs, however, through almost the same latitude from west to east, that is, between 14° and 15° N.

In a previous communication the author and ROUBAUD showed that this line formed the northern boundary of a *morsitans* belt consisting of the whole of that part of Senegal known as Upper Gambia and that this belt coincided exactly with the distribution of the big game. The belt extends southwards over the Gambia River into Guinea territory up towards the line Kadé-Yambéring. Its western limits appear to pass through Kolda in the French Casamance territory and then pass north-eastwards, skirting round the borders of British Gambia. A small belt was also discovered by ROUBAUD in the district known as Niom Bato in the Kaolack region adjacent to fly belts described in the British colony north of the River Gambia. It is probable that this small *morsitans* belt was formerly united to the Upper Gambia belt, but that the inhabiting and cultivation of the intervening districts caused the big game to migrate towards the sparsely populated Upper Gambia.

Towards the east *Glossina morsitans* can be found along the right bank of the Falémé stream and southwards through the villages of Satadougou and Dougasita.

The zone inhabited by *Glossina morsitans* in this part of French West Africa thus occupies an important area characterised by the abundance of big game and sparsity of population. These fly belts are also characterised by the presence of a breed of small cattle known as the N'dama or Fouta Djalon breed, very resistant to trypanosomiases and the tsetse fly, and which, like the big game, play the rôle of reservoirs for the virus. As soon as these animals can be replaced by hybrids and by zebus one may be sure that the tsetse fly does not exist in the district. The tsetse fly limits the extension southwards of the zebu in West Africa and makes it hardly possible to maintain the existence of hybrids.

A study of this region was undertaken by the author, at the request of the Government of French West Africa, on account of the heavy mortality among the caravan animals, especially the oxen, which brought food to the railway workers from the Sudan and from Upper Senegal and Nigeria.

The author then records the incidence of *Glossina morsitans* along a caravan tract constructed at a short distance from the railway line, commencing at Synthiou Coulé at the 440th kilometre; the last Glossina were captured at Naïes near the Falémé stream (575th kilometre). These fly catchings took place in September and October.

The number of females was insignificant compared with the number of males (three females for 75 males at one place on the 1st October), and thus it was thought that reproduction must take place at some other time of the year. According to the natives the flies disappear more or less completely during the dry season [*hivernage*] and only commence to reappear towards the end of September. They are especially abundant during the colder months (January, February and March), and their number diminishes as soon as the hot weather preceding the dry season is felt. Owing to the complete absence of permanent watercourses, except for a few wells which remain during the rainy season and become quickly dried up during the dry season, the conditions are such that no flies of the species *Glossina palpalis* are found in all this region.

Animal trypanosomiases. Experiments were made in order to determine whether the flies of the districts examined were infected and which trypanosomes they were capable of transmitting. A young sucking kid taken from a tsetse-free area was bitten from the 5th to the 23rd October with 88 *Glossina morsitans* captured in three villages. On the 24th October trypanosomes of the species *T. dimorphon* appeared in the blood and the goat died on the 21st November.

T. dimorphon has already been discovered in Upper Gambia and the disease caused by it is thus shown to extend further northwards. In these villages very few horses are found, these belonging to the chiefs only, who are obliged to replace them frequently. The work of railway construction had not penetrated into the fly area and thus out of about 50 horses and mules employed on the work only one was found infected. As the work proceeds there is no doubt that tsetse fly will cause a very considerable losses among horses.

As a rule horses do not survive for longer than one year in this area and care is then taken to keep them within the inhabited areas. Numbers of cattle of the N'dama breed in very good condition were seen in the tsetse area. In other villages just outside the area a certain number of various cross-breds were seen but very few of these could be found within the borders of the fly area.

In one village within the fly area examination of 100 cattle, 5 asses, 7 sheep, and 14 goats was negative. The sheep and goats belonged to the Fouta-Djalon (a southern) breed. According to the natives sheep and goats imported from Morocco die in from two to three months after their arrival in the country. Two out of three dogs of the village showed *T. dimorphon*; dogs appear to be very susceptible to this trypanosomiasis, and according to the natives they all die.

Outside the fly area blood examinations were also made of the various animals, the cattle for the most part being cross-breds and very rare cases of trypanosomiases were found. On the borders, trypanosomes were commonly encountered, especially in cross-bred cattle, sheep, and goats.

The author concludes that the Glossina of this area like those of the Upper Gambia area seem only capable of transmitting the trypanosomiasis due to *T. dimorphon*, and that at the present moment they are free from the other animal trypanosomes, *T. pecaudi* and *T. cazalboui*, of West Africa. It is feared that the passage to the Cold Storage Meat Factory now situated near the coast of Senegal of numerous herds of zebus, in particular from the Sudanese regions, may introduce into the Thies-Kayes area these other two viruses which *Glossina morsitans* is capable of transmitting. Inversely, the clean Sudanese herds passing through this area will become contaminated with *T. dimorphon*, but, as the majority of these animals are destined for slaughter the mortality from this disease will be very small, but infection will certainly be very large. The completion of the railway line will modify this state of affairs if care is taken to place the cattle in screened trucks as has been done on the Ivory Coast railway line.

The changes brought about by the migration of population along the railway line for the cultivation of earth-nuts will gradually cause the disappearance from this area of big game and, consequently, also of *Glossina morsitans*.

MACFIE (J. W. Scott). **The Results of Dissections of Tsetse Flies at Accra.**—*Report of the Accra Laboratory for the Year 1915.* pp. 49–54. With 1 plate. 2 tables and 4 text figs. 1916. London, W: J. & A. Churchill.

Examination of tsetse flies caught in the neighbourhood of Accra was undertaken on account of the great frequency of trypanosomiasis in cattle brought to Accra for slaughter. The flies were fed on various experimental animals and were dissected after having been confined for about three weeks, or at death if this happened earlier.

The following table shows the distribution of infection in the two species of flies caught.

Species of Tsetse Fly.	Number dissected.	Negative.	Spirochaetes in gut.	Sporocysts in abdomen.	Fungal infection.	Trypanosome Infections.				
						Proboscis, gut and salivary glands.	Gut and salivary glands.	Proboscis and gut.	Proboscis only.	Gut only.
G. palpalis ..	75	63	1	2	1	—	3	1	3	4
G. longipalpis ..	8	7	—	—	—	—	—	—	1	—
	83	70	1	2	1	—	3	1	4	4

"*Trypanosome infections.*—Morphologically the flagellates found in nine of the flies were of a pathogenic type, viz., those present in four infections of the proboscis, three of the gut and salivary glands, and two of the gut only. Three flies showed flagellates of the *T. grayi* type in the gut, and these parasites when alive were extremely active and were easily distinguished from the pathogenic types by this fact and by the extreme slenderness of their bodies. When fixed and stained they were seen to include both crithidial and trypanosome forms. The nucleus was large, oval, and situated towards the posterior end of the body; and the micronucleus was large and rod-shaped and was placed near the nucleus, sometimes being anterior to it, sometimes posterior. Two of the flies infected with flagellates of the *T. grayi* type had also a sporocyst infection of the abdominal cavity.

"With regard to the infections with flagellates of the pathogenic type it is difficult to decide what trypanosomes they represented in the absence of positive results from feeding and inoculation experiments. The common trypanosomes at Accra are *T. pecaudi* (*T. brucei* of Uganda), *T. vivax*, and *T. congolense*, and sleeping sickness is not known to occur at Weshiang where the tsetse flies were caught. It is probable therefore that all the infections of the proboscis were *T. vivax*, although three of the flies had been repeatedly fed on a goat without infecting it. The infections of the gut and salivary glands were possibly *T. pecaudi* (*T. brucei* of Uganda), and so were also perhaps the two infections with flagellates of a pathogenic type of the gut only. It must be remembered, however, that according to ROUBAUD *T. pecaudi* develops in the gut and proboscis, and not in the gut and salivary glands. None of the infections resembled stages of the development of *T. congolense*."

Other infections.—These consisted in the discovery of spirochaetes, a fungal infection, and sporocysts in specimens of *Glossina palpalis*; an interesting and minute description, illustrated with figures, is given of the two latter conditions.

OFFERMANN. **Ueber die serologischen Untersuchungsmethoden als Hilfsmittel zum Nachweis der Trypanosomenkrankheiten, im besonderen der Beschaelseuche.** [Serological Tests in the Diagnosis of Trypanosomiasis, especially in Dourine.]—*Arbeit. a. d. Kaiserl. Gesundh.* 1915. Sept. Vol. 50. No. 1. pp. 1–29. With 25 tables.

In this paper a series of experiments is described which were performed with the object of ascertaining the value of the complement and agglutination tests in the diagnosis of trypanosomiasis. The tests were performed on a dozen healthy rabbits which were inoculated at various times with certain quantities of the blood of dourine-infected guinea-pigs when trypanosomes were most abundant in their blood.

A full description of the technique employed in the complement test is given. All the rabbits were tested beforehand in order to determine the quantity of serum required to prevent haemolysis in the haemolytic system before infection. The antigen consisted of an extract of the trypanosomes obtained in a pure state from the blood of dourine-infected rats just before death by repeated washing and centrifuging. All the elements entering into the haemolytic system were carefully titrated beforehand and a full set of the necessary controls was utilised in each test. The stored serum of the rabbit before infection also entered into each series. A microscopic examination of the blood was made daily after infection together with the inoculation of mice in order to determine the first appearance of trypanosomes in the blood. Blood to be used in connection with the complement test was taken from a vein every two to six days after the first four or five days.

For the agglutination test, serum was procured from the rabbits in the same way, and the emulsion consisted of a suspension of trypanosomes obtained in the same manner as for the complement test. The serum was added in the required dilutions, the mixture allowed to remain in the incubator at 37° C. for five hours, and the results were then read off. The agglutination titer on the various dates on which serum was taken is given.

The clinical history is described in the case of each animal.

The author's general conclusions with regard to both these tests are as follows:—

"(1) Sera obtained from healthy rabbits possessed in many cases an inhibitory effect upon haemolysis.

"(2) A regularity in the appearance of the bodies causing the inhibition cannot be determined. While many sera proved very strongly inhibitory, in others this property was completely or almost completely absent.

"(3) In no case in the tests performed could an inhibitory action be observed following the use of 0·01 cc. or a smaller quantity of normal rabbit serum.

"(4) When the serum of a rabbit is to be used in researches in connection with the complement test the serum should be tested before infection.

"(5) No agglutinins causing agglutination of the trypanosomes of dourine could be discovered in normal rabbits.

"(6) In the serum of dourine-infected rabbits complement-binding anti-bodies and agglutinins could be discovered.

"(7) The anti-bodies did not always appear simultaneously. Generally. complement-binding amboceptors appeared earlier than agglutinins. While the first-named were traced as a rule 8–9 days after artificial infection, the latter took 12–13 days to appear.

"(8) The anti-bodies appeared later than the trypanosomes in the blood. The complement-binding amboceptors were traced 4–9 days, and the agglutinins 4–22 days, later.

"(9) The appearance of anti-bodies varied in time and quantity according to the individual animals and the course of the disease. The anti-bodies often decreased during the course of the disease, only to increase again towards the end. A regularity in the appearance of these phenomena could not be determined. In no case did they disappear altogether from the blood.

"(10) By storing the serum with sterile precautions the anti-bodies could be discovered after many months.

"(11) For the agglutination test fresh trypanosome emulsions must be used as they lose their activity when stored.

"(12) The antigens obtained from the trypanosome emulsions for the complement test retained their activity for many weeks when stored in an ice chest.

"(13) The complement and agglutination tests are useful diagnostic methods, as well as the inoculation of blood into white mice.

"(14) As the complement test gives better results than the agglutination test it is to be preferred for diagnosis."

MACFIE (J. W. Scott). **A Trypanosome of the Black Rat.**—*Report of the Accra Laboratory for the Year 1915.* pp. 72–73. With 1 coloured plate comprising 10 figs. 1916. London, W.: J. & A. Churchill.

The author describes polymorphic trypanosomes of the *T. lewisi* type found in immense numbers in the blood of a young black rat (*Epimys rattus*). The longest measured 48μ, the shortest 15μ, average 30·02μ. In breadth they averaged 2·6μ and ranged from 2μ to 6μ. Four types of parasite could be distinguished with intermediate stages between them.

The majority were about 30 to 35μ in length and 2μ in breadth, possessed a well-marked free flagellum, and the posterior extremity was prolonged for a considerable distance beyond the micronucleus.

Very much smaller trypanosomes, some of which measured only 12μ in length were fairly common and in them the posterior end tapered rapidly into a finely pointed cone, and the micronucleus was not infrequently situated alongside of or even slightly anterior to the macronucleus.

Larger broad forms measuring 6 microns at their widest part were also seen.

These three types were very similar to those described by DELANOË (1915) as typical of *T. eburneense*, the first type representing the adult and the other two the multiplicative forms.

In addition, there were some remarkable forms with the posterior end prolonged into a whip-like extension sometimes about 24μ in length. These trypanosomes measured up to 52μ in length and 3 or 4μ in breadth. Intermediate forms were found which seemed to link this type with the commonest form of trypanosome present in the blood. Similar forms were found by LINGARD (1906) in rats. The name *T. longocaudense* was originally proposed for them, but subsequent observations have proved them to be forms of *T. lewisi* which are of "constant occurrence and very numerous at a certain stage of the multiplication period" (MINCHIN, 1912).

VAN SACEGHEM (R.) & NICOLAS (E.). **L'émétique dans le traitement des trypansomiases.** [Tartar Emetic in the Treatment of Trypanosomiases.]—*Bull. Soc. Path. Exot.* 1916. Dec. Vol. 9. No. 10. pp. 813–823.

Reference is made to the researches of PLIMMER and THOMSON and other workers on the use of ordinary tartar emetic, potassium acid antimony tartrate, and its efficacy in the treatment of trypanosomiasis. Mention is also made of the curative results obtained by Van Saceghem in the treatment of all bovines infected with *T. cazalboui* in the Belgian Congo. A therapeutic dose (6 mg. per kilog.), administered subcutaneously, causes the disappearance of trypanosomes in eleven minutes from the peripheral circulation of guinea-pigs infected with *T. ugandae* and *congolense*.

In view of this rapid disappearance of trypanosomes from the peripheral blood following treatment, the question arises as to where the trypanosomes which bring about relapses originate. It appears impossible that there remain forms in the blood capable of resisting the drug because no such forms have been demonstrated by any observer, and if these existed the blood would remain infective which, however, is not the case in animals that have just been treated; also, if the inoculation of trypanosomes into a susceptible animal is combined with the injection of a therapeutic dose of tartar emetic infection is prevented.

One must thus admit that if no trypanosome escapes the action of the drug in the peripheral circulation there are organisms disseminated in various parts of the body, separated from this circulation, and not submitted to its action.

The serum of guinea-pigs which have received a fatal dose of the drug has no trypanocide action in vitro. The drug therefore disappears quickly from the circulation, or else it becomes rapidly transformed locally, or becomes excreted. Its short stay in the peripheral circulation is, however, sufficient to enable it to exterminate all the organisms which multiply in the blood but its "penetrating" action is too small to enable it to reach the trypanosomes hidden in the deeper tissue channels. These trypanosomes serve as the strain which re-infects the peripheral circulation after the necessary period of incubation. It may be that the multiplication of the trypanosomes is also retarded by the formation of antibodies.

When the serum (e.g., of a horse) is added drop by drop to 10 cc. of a saturated solution of tartar emetic an abundant albuminous precipitate is formed which becomes dissolved in a slight excess of serum as well as in alkalis or alkali carbonates. This precipitate does not appear in solutions of antimony tartrate to which common salt has previously been added, or in very dilute solutions. In intermediate concentrations it is replaced by a more or less marked turbidity.

An abundant precipitate is formed if one adds to the mixture of serum and tartar emetic an acid solution (e.g., of tartaric acid), in an excess of which it is not soluble. It thus seems that the alkalinity of the serum when present in sufficient quantity prevents precipitation.

The blood serum, the alkalinity of which is especially due to $NaHCO_3$ and Na_2HPO_4, first of all neutralises the acidity of the tartar emetic and then if present in sufficient quantity causes the appearance of another white, powdery, very fine precipitate composed of a mixture of calcium tartrate and antimony oxide. This precipitation is sometimes slow in appearing.

Experiments in vivo.—If a mixture of equal quantities of a 2 per cent. solution of tartar emetic and horse serum is injected into a mouse it is found that the trypanocide action of the drug is retarded.

It was also found that the addition of serum to the drug diminishes its irritant action in the connective tissue.

The white antimony precipitate, which excess of serum forms in a solution of tartar emetic, injected after washing and centrifugation into a trypanosome-infected mouse, does not possess any direct trypanocide action capable of manifesting itself after a relatively brief interval.

Tartaric acid has no trypanocide action *in vivo.* The administration of 0·01 gramme of tartaric acid into a mouse infected with nagana has an inhibitive effect on the action of a therapeutic dose of tartar emetic. This acid becomes transformed into sodium tartrate in the blood and it has no trypanocide properties, but impedes the action of the emetic.

Hydrochloric acid, at 1 per cent., has no trypanocide action.

Sodium bicarbonate and carbonate markedly diminish the toxicity of tartar emetic.

Experiments in vitro.—Sodium bi-carbonate and carbonate in isotonic solutions have no action on trypanosomes. Solutions of these substances added to a solution of tartar emetic diminish its trypanocide properties.

Tartaric acid used in a 2 per cent. solution has a marked trypanocide action. Previous neutralisation with sodium carbonate prevents this action.

It appears from this result that it is the SbO group of tartar emetic which has the trypanocide property since the tartaric radicle taken separately is, after neutralisation, devoid of all harmful effect on the trypanosomes; it, however, has advantages in that it presents the antimony in a form soluble and stable in the presence of water, easily diffusible and capable of acting more rapidly and more energetically than other forms on the parasites it comes into contact with.

Administration of tartar emetic.—Subcutaneously, the drug produces a considerable swelling and often sloughing but intravenous injections of watery solutions are well supported by man and the lower animals.

Van Saceghem introduced the method of administering the drug into the deep muscle tissues of the neck, after which no abscess formation took place. The drug is held in as fine a suspension as possible in an oily-fatty medium (olive oil or the liquid portion of horse fat or in liquid paraffin in order to diminish its irritant effect on the connective tissue. Camphor, which can be dissolved in the oil, further diminishes the irritant effect on account of its sedative properties. The addition of 5 per cent., for example, of horse serum also causes it to lose in part its irritating properties. These oily camphorated suspensions of the drug are well tolerated after intravenous injection.

By retarding the diffusion of the drug in the blood these suspensions should diminish the toxicity of the substance, and thus allow of larger doses being employed and prolong the duration of its action.

Treatment of trypanosomiasis.—Tartar emetic kills *T. cazalboui* in vitro in solutions of 1/20,000. In the treatment of trypanosomiasis due to *T. cazalboui*, *congolense*, *evansi*, and *equiperdum* (mouse), almost uniformly successful results have been obtained, but in the case of other trypanosomes, such as *T. brucei*, *gambiense*, and *equinum* (mouse), the results are not consistent. The authors believe that failures in the case of the latter trypanosomes are due to their residing in the deeper tissue spaces of the body which are not reached by the drug. The affections produced by trypanosomes transmitted mechanically and hence requiring their presence in large numbers in the blood, hardly ever resist the therapeutic action of the drug. Van Saceghem has thus shown that bovines affected with *T. cazalboui* can be cured by means of a single intramuscular injection of a medicinal dose of tartar emetic.

The various methods of administration are dealt with as follows :—

Large doses dissolved in water are very toxic producing a general depressant action, especially on the heart.

Administration in oily suspensions prevents rapid diffusion and allows of a widespread action of the drug and of larger doses being used. The addition of camphor to the oil has moreover a considerable cardiac tonic effect.

The emulsion is made up as follows :—The tartar emetic is ground up in a mortar as finely as possible and then mixed with some oil into a homogeneous mixture. It is then poured into a flask containing some glass beads and sterilised in a water bath or, if possible, in an autoclave at 110° C. for 15 minutes. After cooling the desired quantity of camphor (10 to 20 per cent.), previously dissolved in a little ether, is added. Before use, the mixture is well shaken up and here the glass beads assist in emulsification.

Subcutaneously, a dose of from 4 to 6 mg. of tartar emetic per kilog. is employed in the case of the large animals and the desired amount is made up to 100 cc. with camphorated oil.

Administered by the mouth the drug has no effect.

Intravenous administration is very effective and the dose given is from 1 to 2 grammes, in the case of the large animals, dissolved in physiological salt solution. BRODEN and RODHAIN have shown that fewer cures are obtained by intravenous than by subcutaneous administration. The authors recommend the introduction intravenously of the drug in an oily camphorated solution as it is thus very well tolerated by animals.

Administered intramuscularly in a dose of 6 mg. per kilog. in 50 cc. of salt solution, the local reaction is *nil* or transient. When administered according to the technique described by the authors no abscess formation ever takes place, and only a small fibrous thickening is left at the seat of injection. The oily suspensions are well suited for this mode of administration and one would employ two grammes of tartar emetic in 100 cc. of camphorated oil.

(g) MISCELLANEOUS.

LOW (G. C.). **The History of the Use of the Intravenous Injections of Tartar Emetic (Antimonium Tartaratum) in Tropical Medicine.**—*Trans. Soc. Trop. Med. & Hyg.* 1916. Dec. Vol. 10. No. 2. pp. 37–42.

The credit for first proposing the use of antimony salts in tropical medicine, viz., in trypanosomiasis, is given to NICOLLE and MESNIL (1906) who were led to suggest it on account of the unsatisfactory results obtained with atoxyl and other arsenic compounds. Reference is also made to the successful results obtained by PLIMMER and THOMSON in 1907 in the treatment of experimental trypanosomiasis.

BRODEN and RODHAIN (1906 to 1908) first tried the effect of administering large doses intravenously to natives suffering from sleeping sickness.

In the treatment of leishmaniasis the first records of the use of tartar emetic injections were made in 1913, when MACHADO and VIANNA successfully treated cases in this manner in Brazil. In the same year ARAGAO and VIANNA treated cases of ulcerating granuloma of the human subject by the same method with excellent results. Further details with regard to the treatment of these diseases by this method are given, together with a list of published papers.

A history of the treatment of trypanosomiasis of the domesticated animals by this method has, unfortunately, been omitted.

CASTELLANI (Aldo). **The Treatment of Certain Diseases of Protozoal Origin by Tartar Emetic, Alone and in Combination.**—*Brit. Med. Jl.* 1916. Oct. 21. pp. 552–553.

Although this article deals exclusively with the treatment of human diseases, a study of the methods employed and the results obtained will undoubtedly be of value in so far as they indicate comparable lines of treatment which might be adopted in the diseases of protozoan origin of the domesticated animals.

"Tartar emetic is of great efficacy in various protozoal diseases. Its powerful action in trypanosomiasis has been well proved, and it can be used as a specific in espundia, granuloma inguinale, kala-azar, and oriental sore. It is efficacious in yaws, especially if combined with other drugs, and seems to have a beneficial action also in relapsing fever."

Various formulae are given, in which tartar emetic constitutes the active ingredient, for oral, intravenous, and intramuscular administration in the diseases enumerated.

Intramuscular injections are stated to be extremely convenient, but the usual solutions of tartar emetic are very painful when given in this way and may induce the formation of an abscess. The following represents one of the formulae devised with the object of eliminating this irritant action:—Tartar emetic, 8 grains; carbolic acid, 10 minims; glycerine, 3 drachms; sod. bicarb., ⅓rd grain; distilled water, up to

1 oz. In the case of the human subject affected with kala azar ½ to 1 cc. of this mixture is injected intramuscularly every other day in the gluteal region.

MACFIE (J. W. Scott). **Bodies Resembling *Paraplasma flavigenum* in Men and Animals.**—*Report of the Accra Laboratory for the Year 1915.* pp. 58–63. With 2 plates (1 coloured) comprising 11 figs. and 1 chart. 1916. London, W: J. & A. Churchill.

In this paper the author refers to SEIDELIN's discovery (1911–1912) in Mexico of *Paraplasma flavigenum* in the red corpuscles of a few human subjects who presented no symptoms of yellow fever, and were considered to be pseudo-carriers of the disease.

The history is given of a disease characterised by fever and debility affecting a European and a native, respectively, in West Africa; the cause of the disease could not be determined but bodies resembling *Paraplasma flavigenum* were found in blood films.

The author discusses the etiological significance of *Paraplasma flavigenum* in yellow fever. The occurrence of similar bodies in guinea-pigs after inoculation with the blood of patients suffering from yellow fever at Lagos in 1913 was discovered by the author and JOHNSTON, but at that time none could be found in the blood of clean guinea-pigs. Subsequently the author found Paraplasma-like bodies in uninoculated guinea-pigs. CONNAL and JOHNSTON (1915) found red-cell inclusions resembling *Paraplasma flavigenum* in nearly 26·5 per cent. of the guinea-pigs they examined at Lagos.

WENYON and LOW (1914) also observed these bodies in guinea-pigs and accordingly attempted to disprove the parasitic nature of *Paraplasma flavigenum* and to discredit the experiments in which these bodies appeared to have been transmitted by inoculations.

In CONNAL and JOHNSTON's experiments the guinea-pigs found to harbour Paraplasma-like bodies after inoculation with yellow fever blood did not in any single case show them before the experiments were begun.

When guinea-pigs were inoculated with normal human blood they found that the pyrexia "was comparatively slight, and the charts differ distinctly from those which recorded the temperature of yellow fever guinea-pigs."

MACFIE (J. W. Scott). **A Further Note on a Disease of Fowls characterised by Inclusions in the Leucocytes.**—*Report of the Accra Laboratory for the Year 1915.* pp. 68–70. With 1 chart. 1916. London, W: J. & A. Churchill.

In this short article, the author describes a fatal disease in a turkey in which inclusions were found in the leucocytes similar to those described by him in 1914 in an outbreak of disease among fowls at Eket in Nigeria [see this *Bulletin*, Vol. 3, No. 1, p. 27].

During life the turkey showed symptoms of marked depression and slight diarrhoea; on examining the blood a few pigmented parasites of the Halteridium type were found in the red blood corpuscles, and a few of the leucocytes contained inclusions. Treatment by means of atoxyl proved unsuccessful and the turkey died on the 4th day; post-mortem examination revealed no gross lesions; the tissues were not anaemic, and the liver and spleen were enlarged.

0·5 cc. of the blood was inoculated subcutaneously into a fowl. Inclusions were found in its leucocytes on the fourth day, and fever and other symptoms afterwards set in. The bird died on the 10th day. The liver and spleen were both enlarged, and inclusions were found in the latter organ similar to those found in the turkey.

Another fowl inoculated subcutaneously with the heart blood of this fowl also developed symptoms of illness on the fourth day, and later a high temperature together with a few inclusions in its leucocytes. By the 11th day it had apparently recovered from the infection, but it did not regain its normal condition until many weeks later.

Two chickens inoculated with blood from this second fowl on the 6th day did not become infected.

The disease in the turkey thus appeared to be not so virulent as that observed in the case of the Eket fowls.

BAYON (H.). **The Development of Pathogenic Properties in Protozoa, with Special Reference to the Herpetomonad Group.**—*Trans. Soc. Trop. Med. & Hyg.* 1916. Dec. Vol. 10. No. 2. pp. 23–32.

This is a purely theoretical paper dealing with the probable evolution of pathogenic properties in protozoa in the light of recent advances in our knowledge of the developmental cycles and incidence of certain protozoa which cause disease in man and other vertebrates. Protozoa of medical interest are tabulated according to their mode of life and pathogenicity. The author classifies spirochaetes in the same manner as FANTHAM who states "that spirochaetes are intermediate in character between bacteria and protozoa, showing morphological affinities with bacteria and physiological and therapeutical (biological) affinities to protozoa."

The principal features and properties of protozoa capable of causing disease in man and other animals are reviewed, and from this classification the author claims to show "that the parasitic protozoa which have the most marked pathogenic properties for man and mammals are those which, as a rule, can be definitely distinguished morphologically from their saprozoic harmless relations." He excludes from this rule the Herpetomonad group. "The pathogenic, even lethal properties of *Leishmania donovani*, and the extreme similarity of its herpetomonad stage to saprozoic races, are a definite and glaring exception to this rule which requires separate attention and expanation."

In discussing the trypanosome group the author concludes that in the case of trypanosomes of great virulence such as *T. rhodesiense*, *gambiense*, *evansi*, *brucei*, etc., the adaptation to a certain form of parasitic life has become so permanent that a reversion to simpler forms is no longer possible. "On the other hand *T. lewisi* with all its mild pathogenic properties adapts itself easily to varying conditions (cultural, etc.), and in so doing repeats its ontogenetical development in a somewhat similar fashion to what has been observed in the embryonal stages of vertebrate life."

In dealing with the herpetomonads the author refers to the experiments of FANTHAM and PORTER, and quotes their conclusions *in extenso* (see this *Bulletin*, Vol. 4, pp. 23 and 146).

He also refers to his own discovery of herpetomonads in the cloaca of *Chamaeleon pumilus* at Robben Island in 1913. He concludes that in the case of diseases such as kala azar "it is quite possible that this group of diseases is acquired by the inoculation through blood-sucking insects of apparently free-living or saprozoic varieties."

A discussion of the behaviour of the pathogenic spirochaetes and amoebae concludes the paper.

DISEASES DUE TO METAZOAN PARASITES.

ROUBAUD (E.). **Les Porcins et la conservation des Ectoparasites humains, dans les régions chaudes.** [The Rôle of Pigs in the Maintenance of Human Ectoparasites in the Tropics.]—*Bull. Soc. Path. Exot.* 1916. Dec. Vol. 9. No. 10. pp. 768–771.

In the course of his researches on the Auchmeromyia the author noted a striking relationship between these blood-sucking larvae found on man and those found on two species of animals (Phacochoerus; Orycteropus)* that are very common in Tropical Africa, live in burrows, and possess a hairless skin. The Cheromyia larva found in the burrows of Phacochoerus and the human Auchmeromyia larva commonly known as the "Congo floor maggot" (*ver des cases*) found on negroes are strictly related inasmuch as both types can be reared experimentally on the pig or on man. It thus appears that, depending on the prevailing conditions, a substitution may take place between the hosts.

The author enumerates a series of ectoparasites which have been established as capable of living on animals or on man. Examples of these are the human tick, *Ornithodorus moubata*, the vector of "tick fever," found by LLOYD in Rhodesia in the burrows of Phacochoerus in uninhabited districts; WELLMAN in Angola and VAN SACEGHEM in the Belgian Congo have also found this tick in the styes of domestic pigs.

The chigger flea of man, *Sarcopsylla penetrans* L., known in Brazil as the *bicho de porco*, was found by VAN SACEGHEM at Zambi in such abundance on pigs as to form veritable walls around the feet, mammary glands, and scrotum.

With regard to biting flies it is stated that in the Island of Principe the tsetse fly best adapted to man, *Glossina palpalis*, is also the common fly found on wild pigs. The Portuguese Commission on Sleeping Sickness found that the distribution of the *palpalis* in the Island corresponded exactly with the migrations of large bands of half-wild pigs. The extermination of these pigs rapidly brought about the disappearance of these insects.

The mange sarcopt of the pig is easily transmissible to man, whereas it has no other hosts; the goat sarcopt is transmissible to both man

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* "Phacochoerus is the wart hog, an African genus of pigs (Suidae). Orycteropus has nothing to do with the pig-family, although superficially like a pig. It is an anteater usually classified in the Edentata."—R. J. POCOCK, F.R.S., F.L.S.

and the pig. NOELLER, working recently on the transmission of typhus, found that the pig louse remains a long time alive on man and inversely the louse of human clothes may remain alive for seven days or longer on the pig.

From these data the author concludes that pigs show themselves to be the animals most nearly related to man as far as the possibilities of the nutrition of ectoparasites are concerned.

ROUBAUD (E.) & VAN SACEGHEM (R.). **Observations sur quelques insectes et acariens parasites du bétail au Congo Belge.** [Some Insect and Acarian Parasites of Cattle in the Belgian Congo.]—*Bull. Soc. Path. Exot.* 1916. Dec. Vol. 9. No. 10. pp. 763–767.

These observations were made at the Veterinary Establishment at Zambi, in a country where until recently stockbreeding had never existed.

(1) *Larvae producing animal myiases in the Lower Congo.*

(*a*) Bot Oestridae.—In the digestive tract of an elephant killed in the Kassai district were found two species of Cobboldia larvae in their third stage. One of these was identified as *Cobboldia loxodontis* Brauer, and the other corresponded with a species recently described by RODHAIN and BEQUAERT under the name of *C. chrysidiformis.*

In the stomach of asses of the Lombardy and Poitou breeds introduced in 1911 larvae corresponding to the type *Gastrophilus intestinalis* of Europe were found. The rearing of some of these produced adults very similar to the form *G. asininus* identified by BRAUER.

It is interesting to note that these parasites are the result of an external importation and local acclimatisation of the species. Originally there were no bots in the Lower Congo on account of the absence of equines, the first animals capable of harbouring these parasites having been brought from Senegal in 1911.

No warble Oestridae were observed on domestic animals or on the wild mammals.

(*b*) Muscidae.—Myiasis due to *Chrysomyia* (*Pycnosoma*) *bezzianum* Vill. (=*megacephala* Bezzi) is frequent among the bovines of the station. Hitherto this myiasis has only been observed in the case of the large domesticated animals,—cattle and horses. It is found also at Zambi on pigs, especially about the ears and scrotum. It was also found on a young domesticated antelope and thus it is probable that the myiasis actually occurs among wild mammals. Cases of the disease always appear as wound complications.

Myiasis due to *Lucilia argyrocephala* Macq., which has hitherto only been found in mammals including man, appears also very widespread among birds. The adult flies of this species were obtained by rearing larvae collected from the wounds of a Barbary duck. Larvae corresponding exactly with the same species were obtained on a fowl. Also pupae collected in the nest of a Tisserins bird (*Ploceus collaris*) developed into the same species of Lucilia. In these nests were also found pupae of *Passeromyia heterochaeta* Vill., a muscid blood-sucking larva of Congo birds, the life-history of which has been described by RODHAIN and BEQUAERT. It appears that the myiasis due to *L. argyrocephala* in birds is consequent upon the antecedent parasitic action of the blood-sucking larvae of Passeromyia; the multiple cutaneous erosions produced by the bites of these larvae and the lesions resulting from scratching in the young birds appear to constitute a port of entry for the parasite producing the myiasis.

(2) *Biting flies and acari on cattle at Zambi.*

Tabanidae.—*Haematopota perturbans* Edw. [see this *Bulletin*, Vol. 4, No. 4, p. 159 for probable rôle in the transmission of *Trypanosoma cazalboui*], *Tabanus canus* Karsch, *T. ditoeniatus* Macq., *T. pluto* Walk., *T. par* Walk., *T. biguttatus* Walk., *T. taeniola* P. B.

Stomoxydae.—*St. calcitrans* and *Lyperosia pallidipes* Roub. are very common on cattle.

Hippoboscidae.—None have yet been observed in spite of the importation of equines.

Pulicidae.—The chigger flea of man, *Sarcopsylla penetrans* L., infests pigs in such large quantities that it forms a veritable obstacle to breeding. The wounds it produces may become gangrenous. The feet, scrotum, and the mammary glands of sows are the parts most often affected. The chigger of fowls, *S. gallinacea* West., is frequent around the eyes of poultry, and it may also infect domesticated cats.

Pediculidae.—*Haematopinus suis* L., is found in abundance on native and imported pigs; on cattle *H. eurysternus* Nitzsch. has been observed around the eyes. *H. tuberculatus* Grib. var. *penicillatus* was found on a buffalo imported from Italy.

Acarinae.—Psoroptic otacariasis is fairly widespread. This disease is also observed in the sheep with the same characters as in the case of the goat; the conchal cartilage is filled with greyish-yellow, compact, very irregularly shaped crusts in which the parasites are found. The morphological characters of the parasites observed in the case of the goat and in the sheep are the same.

Among domesticated rabbits auricular psoroptic mange is also very common, and is of European origin. Likewise *Dermanyssus gallinae* and *Cnemidocoptes mutans* are very common on poultry, and *Chorioptes equi* Her., the cause of symbiotic mange in the horse, is always found among the equines of the station.

Among the Ixodidae collected at Zambi on animals the authors have been able to identify *Rhipicephalus appendiculatus* Neumann, *Rh. simus* Koch, *Rh. capensis* Koch, *Amblyomma variegatum* Fabr. and *splendidum* Giebel, and *Margaropus annulatus* Say, and on an elephant from Kassai, *Amblyomma tholloni* Neumann. Also, in the piggeries in the district of Paso-Kondé the human tick *Ornithodorus moubata* was observed in great abundance in the rotten wood of the pigstys. Relapsing fever has not been discovered in the district and Argas is unknown to the natives. The examination of some Ornithodorus for spirilla proved negative. This was the only district in which these Argasidae were found.

MORSTATT (H.). **Bestimmungsschlüssel der in Deutsch-Ostafrika bekannten Tsetsearten.** [The Tsetse Flies of German East Africa.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1914. Aug. 2. Vol. 18. No. 16. pp. 574–575.

A description is given of the external diagnostic characters of the tsetse flies in German East Africa, viz., *Glossina palpalis* R. D., *Gl. austeni* (*tachinoides*) Newst., *Gl. morsitans* Westw., *Gl. pallidipes* Aust., *Gl. brevipalpis* (*fusca, tabaniformis*) Newst.

GLAESER (Hans). **Bestimmungsschlüssel der in Kamerun und Togo bekannten Tsetsearten.** [The Tsetse Flies of the Cameroons and Togoland.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1914. Aug. 2. Vol. 18. No. 16. pp. 571–573.

The external diagnostic features are given of the known tsetse flies of these countries.

Cameroons.—*Glossina ziemanni* Grünb., *Gl. tachinoides* Westw., *Gl. caliginea* Aust., *Gl. palpalis* Rob-Desv., *Gl. pallicera* Big., *Gl. tabaniformis* Westw.

Togoland.—*Gl. palpalis* Rob-Desv., *Gl. longipalpis* Wied., *Gl. morsitans* Westw., *Gl. fusca* Walk.

*VEGLIA (F.). **The Anatomy and Life-History of** *Haemonchus* (*Strongylus*) *contortus* (Rud.).—*Union of South Africa. Third & Fourth Reports of Director of Veterinary Research.* 1915. Nov. pp. 347-500. Extracted in the *Jl. Comp. Path. & Therap.* 1916. Sept. Vol. 29. No. 3. pp. 265–277.

Free Life.

The Egg.—Eggs were obtained for examination and for cultural purposes by making a decoction of faeces, passing through a sieve, repeatedly sedimenting the liquid and centrifuging the sediment, from which the eggs were collected by means of a pipette. The egg is oval and measures on an average 70·9 by 45·9μ and when laid by the female is mostly found to be in the four-cell stage. In the stomach of the host eggs at the 6-, 7- and 11-cell stages may be found, and exceptionally at the "morula" stage. No eggs beyond the "morula" stage are ever found in the intestinal tract.

Under favourable conditions after 12 hours the eggs obtained from faeces or laid by females show distinct movements of the embryo within them and by the 17th hour about 50 per cent. of the eggs were found to have hatched. The remainder hatched slowly, but by the 48th hour only a few eggs had not hatched. Hatching of the embryo appears to take place by rapid pushing movements of the head against the shell wall. Eggs obtained from faeces were found to hatch sooner than eggs laid by the female, this being probably due to the fact that while the eggs are passing through the intestines the evolution of the embryo continues.

Larvae.—Different methods were used in the cultivation of the larvae according to the object in view. For diagnostic purposes faeces moistened with water if necessary were placed in a thin layer at the bottom of a suitable covered glass vessel, and placed in an incubator at 26°–35° C. or kept at room temperature. If development occurs the larvae are seen to crawl up the wall of the vessel four days later and can be recognised as white masses branching out in various directions.

When the object was to obtain a large stock of larvae the normal droppings of sheep were found to be the best medium. These were placed in a jar 9 cm. in diameter and 20 cm. high, which was covered

* A short reference to this article has already been made in this *Bulletin* (1916. Dec. Vol. 4. No. 4. p. 166). The above extract of the parts dealing with the bionomics of the worm is inserted at the request of a reader.

with a lid and kept at room temperature. Sufficient air was available inside to permit of the eggs hatching but when fermentation took place all further development ceased. Diarrhoeic faeces and material from the caecum and colon gave very poor results.

For studying the larvae liquid or solid media were used. The best liquid medium was found to be a boiled and filtered decoction of sheep's faeces placed in a layer of about 1 to 3 mm. in thickness at the bottom of a Petri dish; after inoculation with eggs this was enclosed in a covered evaporating dish, and placed in an incubator. Larvae could then be examined microscopically from time to time at room temperature without affecting the rate of development. The best solid medium was found to be a 0·5 per cent. agar concentration, prepared in the same way as the liquid medium.

Eggs placed in pure water were found to hatch but the larvae did not develop and soon died of starvation.

Development of the larvae.—In their evolutive cycle the larvae of *Haemonchus contortus* pass through five stages, separated by structural changes. The first two stages and part of the third one are passed outside the host as free larvae. The second part of the third stage and the fourth and fifth stages are passed in the hosts as parasites. Each stage can be divided into two sub-stages, viz., the first one in which the larvae move rather actively, feed, and develop and a second one in which the larvae are found in a lethargic condition when they neither move nor feed, but undergo structural change. Entering the fifth stage the worm is sexually mature, and is usually called the adult worm.

First Stage.—The naturally hatched larvae vary in size from 340 to 350μ by 15–20μ, and belong to the rhabditiform type. The body is cylindrical, decreasing in thickness from the base of the oesophagus to the tail. After executing a series of active wriggling movements for about an hour after hatching, the larvae commence to feed and steadier movements, which are somewhat slow, are noted. The chyle intestine cells become packed with granules, the larvae stop feeding, become stationary, and enter into the first lethargic condition; this takes place in from 10 to 12 hours, or 24–27 hours after the eggs have been passed by the host. After 8 or 10 hours the larvae revive.

Second Stage.—Ecdysis first of all takes place and the larvae soon increase in size to 500μ, and the lateral lines on the skin become conspicuous. The larvae show active swimming movements, begin to feed again, and the intestinal lumen becomes straightened out and increases in diameter. When sufficient food has been obtained the larvae again move with the object of hiding in the interior of the medium and the second lethargic stage sets in. The beginning of the second lethargus seems to take place after 40 hours after the first ecdysis, or 50–60 hours after the hatching. After about 12 hours the development of the lethargic stage is completed and with the accomplishment of the rather pronounced structural changes the larvae awaken.

Third Stage.—The Mature Larvae. The larvae awaken from the second stage as soon as conditions are favourable, in general three days after hatching. They now execute swimming movements which are fast compared with those noted in the second stage. Another peculiarity is the attempt of the larvae to rise, their object being to reach a suitable locality from which they can find access to the host.

Ecdysis next takes place. In size they varied between 571 by 21μ to 820 by $26 \cdot 5\mu$. A certain contraction of the tissues takes place by which the size of the body sensibly decreases while the outer skin becomes thicker and increases in rigidity. Vacuoles in varying numbers and of different sizes are present in the chyle intestine cells and these vacuoles become especially frequent in larvae exposed to unfavourable conditions such as dryness, light, or heat.

Influence of the Environment on the Eggs and Larvae.

Toxic substances produced in the intestine of the host or in faeces as the result of abnormal fermentation interfered with the evolution of the egg and sometimes effected its destruction. Similarly certain chemical compounds such as beta-naphthol, thymol, and picric acid, were tested on eggs and found not only to inhibit development but actually to destroy the vitality of the egg.

A certain amount of air is required for development. The amount needed is very small, but if it falls below a certain minimum inhibition of growth and finally death will occur. Cultures of faeces thus do not develop if made into too thick a paste with water or if carried out in liquid media more than 3 mm. in depth. More air seems to be required for developing eggs and larvae than for resting eggs and mature larvae. Mature larvae kept in water at a depth of 3 cm. were still alive after three months.

Temperature.—The optimum temperature for the development of eggs and larvae was found to be between 20° and 35° C. Accordingly, the author calls normal temperature that lying between 20° and 35° C., high temperature that above 35° C, and low temperature that below 20° C.

A very large number of laboratory experiments were made on the development of the worm at these temperatures, the resistance to extremes of temperature, and the effect of alternating temperatures.

With regard to the effect of various temperatures in the field the following statements are made :—

"In considering first of all high temperatures, the maximum recorded in South Africa under conditions of cloudy moist weather cannot be considered to prevent the development or to kill the larvae of *Haemonchus contortus*. In sunny weather, when the ground is moist, the larvae lying in wet earth or faeces are not necessarily exposed to the same maximum of temperature as that of the atmosphere. Moreover, in these conditions the larvae are able to escape from direct sunlight and shelter in cooler places. The high temperatures experienced on the veld during the summer time help to kill a large number of larvae but, at the same time, many of these larvae can be killed before the maximum temperature is reached. The average summer temperature in South Africa is very favourable for the development of the larvae of *Haemonchus contortus*.

"Concerning the low temperatures experienced in South Africa it may be said that the normal spring and winter temperatures do not prevent the development of eggs or larvae but prolong the period required before the larvae reach maturity. The resistance to adverse conditions of eggs and larvae, and their ability to develop considered in relation to the effects of temperature in the winter season of South Africa depend chiefly on the absence of uninterrupted spells of low temperature ; the minimum even if occasionally very low only lasts for a short time during the night, whilst in the daytime the average is the optimum temperature required for the growth of the larvae. In a moderate cold ambient, the larvae also remain in a better state of preservation and for a longer period than in warm weather."

Moisture.—The best consistency of faeces for the hatching of eggs and growth of larvae has been referred to above. It was found that in a liquid medium kept immobile and deeper than ½ cm. a rather small percentage of the eggs hatched after four days, but the larvae made very little progress and within 12–15 days death occurred, presumably owing to lack of air.

The mature larvae appeared to find in water a suitable medium for preservation. A small percentage were found to be living up to the fifth month. The pools of water in the veld thus appear to constitute a suitable environment and to a certain extent a favourable place for infecting the host. The mature larvae appear to prefer pure water to faeces.

With regard to the action of desiccation on mature larvae the following conclusions were arrived at :—

"(1) The larvae of *Haemonchus contortus* do not resist complete desiccation and die before this condition is reached, but under natural conditions they resist (on account of their peculiar structure) the progress of desiccation for a comparatively long time.

"(2) The larvae preferably remain in moist surroundings and by migrating are in a position to seek shelter where the moisture is more constant.

"(3) When dryness sets in the larvae gather in clusters, a peculiarity which can easily be observed under the microscope. These clusters play an important rôle in the preservation of larvae in the field against drought, chiefly when the larvae are surprised on grass by the evaporation of dew or rain."

In a number of laboratory experiments it was found that mature larvae lived for five months in water whilst in dry faeces in the same room after eight days 50 per cent. were dead, and in the desiccator the majority died within four days.

Light.—The eggs and larvae develop under conditions of light such as are observed during the night time or in an incubator. The larvae do not reach maturity if exposed to a diffused bright light during the day. If the diffused light is weak as is noticed in rainy weather they reach maturity equally as well as they do in darkness. In faeces exposed to a strong diffused light the larvae grow as usual; it seems that the larvae pass a certain part of their developmental period on the surface of the pellets when in diffused light. Direct sunlight appears to have a very destructive effect as the larvae hatched out of eggs thus exposed were found invariably killed at the end of the second day; mature larvae were nearly all dead on the fourth day of exposure.

With regard to the action of the sun on infected faeces in the field the following general observations were made :—

"(1) When the weather is warm and the rain is constantly falling for three days, or the ground is kept moist for the same length of time, with a heavy cloudy sky, the majority of the larvae reach maturity

"(2) When the weather is warm and dry, as during the period of drought in summer, or dry and sunny, as in winter, practically all the eggs and young larvae in scattered pellets are killed in two or three days, even if amongst ordinary veld grass.

"(3) Concerning variable weather it is not possible to give any definite rule, owing to the action of the ambient being too complex "

"When infected faeces are passed out on to the veld, a fall of rain, even if prolonged for a day at a time, is not sufficient to allow the majority of the larvae to reach maturity, if sunshine is again constant for a few days. It is only during protracted, rainy weather that a large percentage of eggs reach maturity. This fact, connected with the facilities the mature larvae have of reaching the host if the surroundings are moist, explains the heavy infection that is noted in a flock after a heavy rainy season.

" Even in summer the percentage of larvae reaching maturity is very low, but the percentage of eggs deposited in the field is very high. (It was calculated that the number of larvae that would hatch from the faeces of an infected sheep when placed in suitable conditions would attain the daily average of three millions). The sun is the chief agent of destruction for eggs and larvae under natural conditions of the veld and the mortality increases with increased dryness of the soil and atmosphere."

Migration of the Mature Larvae.

Very thorough experiments were performed in this connection; the following are the author's conclusions :—

" (1) The mature larvae of *Haemonchus contortus* crawl on to the grass under favourable conditions of moisture, light and temperature.

" (2) The larvae withdraw to the lower part of the grass or into the ground when the surrounding conditions are unfavourable and re-appear on the grass with the return of the favourable conditions.

" (3) The succession of night and day produces a nocturnal ascent and a diurnal descent of larvae on the grass, provided the conditions of moisture are favourable.

" (4) The period during which a colony of larvae, when not interrupted, performs the ascending and descending migration, was found under artificial conditions to last from 20 to 30 days; it varies within rather wide limits according to a difference of the ambient.

" (5) In the veld, at the end of the migratory period, part of the larvae are found dead or alive on the grass; the majority are found sheltered in the tuft of grass, at various depths in the ground.

" (6) It was repeatedly observed that the larvae in the ground were richest in food granulations and in a better condition of preservation than those on the grass. It appears consequently, that the migratory period results in a natural selection of the species by which weak specimens will soon die from exposure, while the stronger are able to find shelter and resist exhaustion.

" (7) The mature larvae stored in the ground are able to pass the winter season without heavy mortality.

" (8) The presence of larvae in the soil cannot be explained by the penetration of the superficial water alone but is due to 'geotropism of the larvae.' "

Infection.

The direct introduction of mature larvae through the mouth of the sheep is always followed by the presence of parasites in the stomach, and the infection was invariably found to be proportionate to the number of larvae administered. Frequently, mature living larvae were found in the droppings the day following the administration. The result was always negative when lambs were affected with eggs or larvae in the first and second stages.

It was found impossible to infect lambs through the skin although the method employed proved to be effective for other species of larvae.

Parasitic Life.

The period of time required for development from the moment when the larva enters the stomach of the host until it reaches the adult stage seems to be liable to variations owing to influences not yet properly understood, but the average can be estimated to be 15 days.

First parasitic stage (or, *parasitic part of the third stage*).—Larvae introduced into a sheep by means of water reach the abomasum, and here undergo the second ecdysis. The majority of the moulted larvae then take shelter in the mucous membrane of the stomach; only a few are washed into the intestines. They now begin to feed and are found lodged between the epithelial processes where they shelter without actually piercing the mucous membrane.

The third lethargus is reached from the 30th to the 36th hour after the larvae have gained access to the host and lasts about 12 hours. The larvae in this state are more or less curved, completely immobile and hard to waken.

Second parasitic stage (fourth larval stage).—The growth of the larvae in this stage appears to be very rapid, for shortly after the third ecdysis many larvae are found to reach up to 1 mm. in length. The larva attaches itself to the mucous membrane by means of its buccal aperture, produces a small haemorrhage, and a clot is formed which surrounds the worm. This is observed three days after drenching with mature larvae. The clots are frequent and measure 1 to 2 mm. in diameter. By the sixth day of this stage the sexes can be easily recognised, and on the succeeding days this distinction becomes more and more apparent. On the ninth day the clots have not increased in size or number but are rather flatter, more contracted and darker in colour. The fourth period of lethargus then succeeds.

Adult worm (fifth stage).—The fourth ecdysis takes place between the 9th and 11th days, preceded by a period of lethargus lasting for about 24 hours. The male now measures over 5 mm. by about 90μ in thickness. The mouth cavity is now armed and corresponds in every particular to the mouth of the fully-grown worm. The female measures between 6·5 to 7·9 mm. by from 90 to 130μ in thickness.

On examining the stomach of a sheep 12 days after infection numerous blood clots are present, but they have now become more contracted and of a black colour, adhering to the mucous membrane, whilst petechiae of recent origin are usually found under the clots. These petechiae are caused by the piercing of the mucous membrane by the new mouth apparatus of the larvae, and differ from those previously described inasmuch as they are punctures without any escape of blood. It is rare to find worms outside the clot.

The stomach of a lamb infected 15 days previously still shows in some cases dark red blood clots adhering to the mucous membrane whilst in other cases the clots consist of a residue of yellowish fibrin and ingesta mixed together. In all cases the worms are found in between the clots or distributed on the surface of the mucous membrane itself. Some worms are now found in copulation.

Eighteen days after infection all the clots and fibrin deposits have practically disappeared. In a heavy infestation the mucous membrane is swarming with adult worms. The petechiae are numerous and small, but without any fresh blood clot. Numerous worms are in copulation and numbers of females have laid eggs. The male at this stage measures from 12–13 mm. in length and the female about 17 mm.

Anatomy of the adult worm.—This is described at great length in the original article. The size of the adult worm is given as (1) when collected: male, 15–18 mm., female, 25–29 mm.; (2) after death: male, 18–21 mm., female, 25–31 mm.; (3) 48 hours after collection: male, 17–19 mm., female, 23–27 mm.

VELU. **Un cas interessant de cénurose chez la gazelle.** [An interesting case of Caenurosis in a Gazelle.]—*Rec. Méd. Vét.* 1916. Oct. 15. Vol. 92. No. 19. pp. 555–556.

The gazelle in question was brought for examination to the author with a history of a large swelling of the right shoulder accompanied by lameness. It was found on examination that these apparent defects were simply due to a marked inclination of the neck towards the left. The other symptoms and especially the turning movements led to the condition being diagnosed as one of caenurosis. Three weeks later the symptoms were more pronounced, the animal having become affected with epileptiform fits on two occasions, and a small soft tumour about as large as a pigeon's egg was discovered between the roots of the horns.

In the course of an operation for the excision of this tumour an oedematous swelling of the upper eyelid was noticed causing exorbitation of the eyeball. A caenurous sac 40 cc. in capacity was extirpated, but the gazelle subsequently died from cerebral haemorrhage. Post-mortem examination showed that this large sac had caused partial absorption of the cranium, which had become perforated in many places, the two largest perforations being on the forehead and at the bottom of the orbit, respectively.

PIETTRE. **L'onchocercose bovine dans l'Amérique du Sud.** [Bovine Onchocerciasis in South America.]—*Bull. Soc. Cent. Méd. Vét.* 1916. July 6; *Rec. Méd. Vét.* 1916. July 30. Vol. 92. No. 14. pp. 202–203.

This disease is very common in South America as is shown by the following figures obtained in the case of cattle slaughtered for the manufacture of preserved meat.

Argentine Republic.—Frigorifico La Negra: 70 per cent. of the carcases showed marked lesions of the cervical ligament; 25 per cent. centres on the external surface of the great trochanter.

Uruguay.—Frigorifico Uruguaya: 90 per cent. cervical lesions; 18 per cent. trochanteric lesions.

The distribution of Onchocerca is very different from that usually seen in France. The parasite is found more especially on both surfaces of the cervical ligament between the 1st and 5th dorsal vertebrae, and next at the level of the trochanter between the attached fibrous aponeuroses. The lateral ligaments of the femoro-patellar joint are only exceptionally invaded (16 cases out of 1,000 carcases). The numerous specimens of Onchocerca isolated from the cervical ligament possessed a much greater length than those observed in France; the females reached up to 70 cm., although most often one of their extremities was missing. It is supposed that the loose tissue in which these nematodes develop favours their growth, whilst the density of the ligaments of the stifle joint retards it.

The zoological characters appear to be similar to those of the French form. However, the tail of the male showed six papillae grouped together and two widely-separated small ones, whereas only four could be found in a specimen of *Onchocerca gibsoni*.

The lesions provoked are more marked than in French cattle. One observes congested areas with a peripheral oedema, large verminous nodules surrounded by reacting tissue, pockets hollowed out in the inflamed connective tissue and, finally, very numerous encysted purulent centres.

MYCOTIC DISEASES.

(a) Epizootic Lymphangitis.

Aubry. **La lymphangite épizootique dans la région de Meknès. Organisation de la lutte.** [Epizootic Lymphangitis in the Meknès Area. Method of Eradication].—*Bull. Soc. Cent. Méd. Vét.* 1916. Nov. 9; *Rec. Méd. Vét.* 1916. Nov. 30. Vol. 92. No. 22. pp. 337–346.

This disease was imported into Western Morocco from Algeria by the army of occupation and made its appearance in the Meknès area in 1911, after the conquest of the town. Its rarity in the country districts three years after the French occupation testifies as to its imported origin. On account of the very bad hygienic conditions, hardships, and saddle injuries which beset the horses and mules, the disease rapidly propagated up to 1915 until all units became contaminated in spite of the equine population being scattered in isolated and widely separated stations.

Unfortunately the veterinary infirmary at Meknès into which affected animals were collected was situated amongst other troops, rendering the propagation of the disease still easier; sanction was finally obtained at the beginning of 1915 for the construction of a lazaret between two high walls 4 kilometres away from the camp.

The majority of affected animals admitted was composed of harness or pack animals, that is, animals bearing harness sores. In spite of the prophylactic and therapeutic measures adopted the number of cases exceeded 100 at the commencement of 1915, fell down to 10 at the end of the year, and rose up again to 70 during the winter 1915–1916 during the rainy season. Five animals remained under treatment at the end of the summer of 1916, moreover affected only with sores of limited size.

The following résumé shows the number of animals dealt with at the lazaret :—

Year.	Admitted.	Died.	Destroyed.	Cured.
1914	259	4	50	205
1915	412	2	89	321
1916 (to 10th Aug.)	95	4	11	80
Total	766		160	606

The economic aspect of the disease thus assumes considerable importance both on account of the losses involved by death and destruction and by the cost of upkeep and loss of utility of the animals during the period of infection. The author deals only with the military effectives in this article but the losses among civilian animals have become serious, especially in the country districts. In eradicating the disease he thus aims at (1) the destruction of actual centres, and (2) guarding against infection of civilian effectives, on which it would be very difficult to take action in a native environment.

Diagnosis of the disease.—The author believes that by means of a simple clinical examination the disease can be easily differentiated from glanders and this is important as in most cases a microscope would not be accessible to the practitioner. Under the low power of the microscope the cryptococcus is easily discernible.

Prophylaxis.—Under the conditions which obtain in the field in Morocco this is very difficult and the part played by the veterinary surgeon of a column or of an outpost consists in eliminating affected animals and transferring them to the rear; during this time the cryptococcus multiplies in the sores and is liable to infect other animals en route. The veterinary surgeon in charge of the intermediate post has greater facilities on account of his fixed position.

Nine times out of ten contagion is brought about through harness wounds and these become infected with the cryptococcus, living in moist earth and dung, by means of contact with harness, earth, flies and personnel in charge. The effect of earth is shown by the number of mules affected especially during the rainy season, as these animals are accustomed to roll on the ground.

The author insists upon the necessity of educating all ranks upon the nature of the disease and accordingly he formulates a list of instructions to be followed by them.

With regard to curative treatment the results enumerated above were obtained by adopting the following measures :—

(1) By the installation of a lazaret.

(2) By the simplest surgical measures, after having tried different more or less difficult and costly treatments. The procedure employed is as follows :—(*a*) Wide opening of abscesses, buds, or corded lymphatics, (*b*) extirpation of affected glands and corded lymphatics if possible, (*c*) washing absolutely forbidden.

The wound is dried (the cotton wool is then burned) and sprinkled with pure powdered potassium permanganate or any other strong powder.

In discussing this paper Bridré notes that the results obtained by Aubry appear satisfactory, but that they might be still more so if internal treatment had been administered in certain cases. As an example he refers to an extremely severe inoperable case which received potassium iodide daily in its drinking water according to Cartier's method and three injections of novarsenobenzol. The treatment lasted four months but the horse was cured and treatment appeared justified on the account of the value of the animal. Cases should not be considered incurable because they are inoperable. The economic aspect should be considered in each case before adopting a line of treatment.

Cartier (J.). **Note sur le traitement de la lymphangite épizootique par l'iodure de potassium.** [Treatment of Epizootic Lymphangitis by means of Potassium Iodide.]—*Rec. Méd. Vét.* 1916. Nov. 15. Vol. 92. No. 21. pp. 614–618.

In the treatment of epizootic lymphangitis, potassium iodide was administered intravenously by Trypaz, but his method appears inconvenient on account of the necessity of frequently repeated injections and of the introduction of a chemical agent of a great diffusibility into the blood.

The author himself introduces the drug by means of the digestive tract, although this simple method seems to have been abandoned on account of the failures recorded. The potassium iodide should be administered in large doses; from 12 to 20 grammes were administered daily without the appearance of any toxic symptoms. The tolerance of the patient is first tested by means of a relatively large dose, 12 to 14 grammes for example, and the attainment, as rapidly as possible, of the maximum tolerated curative dose is recommended. On account of its diffusibility the administration of the drug at least twice a day is also advised; a 10 per cent. solution, for example, is given in a small mash before each feed. The treatment need not be continuous, and it is advantageous to interpose periods of rest.

The author then details a series of seven observations made in the treatment of more or less advanced cases of epizootic lymphangitis. Cures were obtained in all cases in from about one up to three months.

[The expense of this treatment appears to be a considerable obstacle to its general adoption.—Ed.]

CHAPRON (H.). **Observations relatives à l'incubation de la lymphangite épizootique.** [Incubation Period of Epizootic Lymphangitis.]—*Bull. Soc. Cent. Méd. Vét.* 1916. Dec. 7; *Rec. Méd. Vét.* 1916. Dec. Vol. 92. No. 24. pp. 402–404.

This short article gives a history of four cases of epizootic lymphangitis occurring in horses which have been issued, each to different units in the French Army, from a depot at a certain date. As these horses must have contracted the disease before they were issued to the units the period of incubation under natural conditions could be easily calculated, and this was 80, 84, 112, and 121 days, respectively, for the four animals. These figures confirm the results of experimental inoculation, by means of which the incubation period had previously been shown to be very long.

NICOLAS (E.). **La lymphangite épizootique en France. Son traitement par la méthode Chatelain et sa prophylaxie.** [Epizootic Lymphangitis in France. Treatment by Chatelain's Method and Prophylaxis.]—*Bull. Soc. Cent. Méd. Vét.* 1916. Nov. 9. *Rec. Méd. Vét.* 1916. Nov. 30. Vol. 92. No. 22. pp. 334–337.

This treatment, which consists essentially in the local application of copper sulphate deserves, in the author's opinion, to be made more extensively known on account of the facility with which it can be applied in the field, and on account of the very good results obtained. The procedure is (*a*) open the buds and abscesses by means of a cautery, evacuate the pus, and insert into each puncture a crystal of copper sulphate proportional to the size of the lesion (usually about the size of a pea); (*b*) around the infected area inject 5 cc. of an iodine solution (tincture of iodine, 2; water, 8; potassium iodide, qs.) by means of a hypodermic syringe.

In the author's experience the second part of the treatment is liable to produce considerable swelling and he substitutes for it the following · (c) along an excentric line around the infected area and 10 cm. from it a series of punctures, 10 cm. apart, is made by means of a cautery, and a small crystal of copper sulphate is inserted into each puncture.

The affection then remains localised, the buds are reabsorbed. abscesses cicatrise, and corded lymphatics disappear. The affected animals should be carefully observed so that if necessary ulcers which are slow in healing may be cauterised again with copper sulphate and new buds treated as soon as they are formed.

With regard to prophylaxis the author enumerates points dealing with strict isolation, the necessity of using fresh swabs for each ulcer. and the avoidance of dressings. Under field conditions in France all cases of ulcerative lymphangitis should be considered epizootic, and treated as such.

The author refers to the parasite of the disease as *Leucocytozoon piroplasmoides*, a name given to it by Ducloux in 1908.

Bridré, in discussing this communication, refers to the work which has since been done to show that this name is incorrect inasmuch as it is not a Protozoon but a vegetable parasite closely related to the Blastomycetes.

Société de Pathologie Comparée. 1916. Oct. 10 & Nov. 14.—[Epizootic Lymphangitis.]—Reports extracted in *Rev. Gén. Méd. Vét.* 1916. Dec. 15. & 1917. Jan. 15. Vols. 25 & 26. Nos. 300 & 301. pp. 632–636 & 39–40, respectively.

In two sittings of the above society papers were read and discussions took place on epizootic lymphangitis; the main points are extracted below.

Chenier, in his paper, states that formerly this disease was generally considered as a cutaneous form of glanders, and accounted for each year (in France) from 200 to 300 victims. For the last thirty years it had almost completely disappeared; only a few rare cases were still observed in the French African possessions. It has been re-introduced into France probably by means of horses from Algeria, and, at the present moment hundreds of cases of it occur. Attempts at intensive therapeutic treatment have been made. Bridré, of the Pasteur Institute, has employed novarsenobenzol, others have had recourse to galyl and potassium iodide. The results are not yet conclusive. Whilst recognising the value of researches made in this direction Chenier, formerly a military veterinary surgeon, to whom we owe the differentiation of glanders from epizootic lymphangitis, as well as the determination of the mode of transmission of the latter disease, believes that it would be unwise completely to abandon cauterisation of abscesses by means of the hot iron, a method of treatment which has been thoroughly tested.

In discussing this paper Petit (A.) states that out of more than 200 cases met with in Morocco he never observed contagion to take place by means of immediate contact. In several cases in which the lesions first affected the eyes, he found the dead bodies of flies in the folds of the conjunctiva, and hence thought that the fly acts as a vector of the disease. He never saw the lesions extend beyond the deeper layers of the dermis.

Surgical treatment with the excision of the corded lymphatics seemed to expose the patients to relapses, either by external re-infection or by omitting to excise the whole of the infected tissue; moreover, cicatrisation is slow and often defective. In order to obtain the largest number of cures in the shortest period of time he thus adopted a treatment consisting in (1) application of a blister, (2) puncturing if necessary, (3) disinfecting the opened abscesses by means of a non-irritating antiseptic.

Curetting favours re-infection and is not recommended. Mercurial blister was even applied over the borders of the eyelids and produced only a temporary inflammation.

The disease appeared to be more severe in the district of Casablanca, with a moist climate, than in the district of Marrakech, a dry country.

Fayet and Bonnel in their paper now disclaim having successfully cultivated the causal organism; the mould resembling Rivolta's cryptococcus which they claimed in a previous communication to have cultivated was in reality a saprophyte from outside sources. Attempts at cultivation from further cases on glycerinised potato have remained negative.

Bridré, in discussing a point raised by Brocq-Rousseu, adduces facts which all workers who have studied the disease hold to incriminate the cryptococcus as the sole cause of infection.

Bilhaut uses chloride of zinc for the suppurative lesions, or other agents such as petrol.

Bridré states that intravenous injections of novarsenobenzol appear remarkably efficacious if administered in sufficient doses, that is, three grammes per horse. The good results claimed to have been obtained by Cartier following the administration of large doses of potassium iodide by ingestion were also corroborated by him.

Chenier believes that while the newer methods of treatment are advisable in some cases one should not be induced to slaughter cases that could be easily cured by the older methods of treatment.

Epizootic lymphangitis with ulcerative lesions of the pituitary mucous membrane.—Cazalbou and Morel (G.) state that glanders even in its clinical form may be mistaken for epizootic lymphangitis, when no reaction follows the mallein test. There exist, however, symptoms characteristic of epizootic lymphangitis but, as it happens, still badly understood.

Whereas it is not very serious to confuse ulcerative lymphangitis with cryptococcic lymphangitis it is far more so to assign Rivolta's lymphangitis to glanders, for in the latter case, one treats a glanderous animal. It would be advisable that special attention should be drawn to those cases labelled epizootic lymphangitis with ulcers of the nasal mucous membrane, in order that the animals might be examined as closely as possible.

Olver states that in the Sudan and in India he observed many cases of lymphangitis with nasal lesions and it was very difficult to differentiate them from glanders. The disease in these countries is very serious and the very numerous flies appear to play a part in its spread, as they were found in the canthus of the eyes of affected animals. In South Africa no nasal lesions were observed in the numerous cases of lymphangitis encountered.

Cases in which pulmonary lesions occurred were mentioned by BRIDRÉ, the first having been published in 1912. In view of the fact that the rôle of flies has been much discussed this observer notes, however, that the disease is especially common in winter during the wet season, which is precisely the season in which flies are least numerous.

In the Sudan, OLVER also noted that it was during the wet season that cases were most frequent, but the long period of incubation must be taken into account. In any case it is certain that the infection can be transmitted by means of dressings, and it is possible that a fly may carry the virus in the same manner from an affected to a sound animal.

JACOULET quotes TEPPAZ who studied epizootic lymphangitis in Senegal, where the natives consider it as a disease of districts infested with flies and appearing when the animals come down into the marshy bush country, and disappearing of its own accord when the animals return to the wind-swept uplands not very favourable to the flies. It is also remarked that these hot moist regions are, as well as being infested with flies, also well suited to a cryptogam flora. However, as evidence against the theory of fly transmission it has been brought forward that the disease occurs more especially during the season when they are very little seen. With these facts in view one must, however, take it into account, firstly, that the period of incubation varies from 60 to 125 days, and of the fact that in Oran, for example, there is hardly any time of the year in which flies are not seen and that it is during these intermediate rainy seasons that they are most tenacious.

JACOULET also refers to a communication of PETIT (A.) who argued that in several cases where the infection first involved the eyes, and the bodies of dead flies were found in the folds of the conjunctiva, the fly should be considered as the principal propagating agent. PETIT was here probably confused for further on he states that he has never seen the disease extend beyond the depth of the dermis whilst in reality the lesions are generally deeper and are seated in the lymphatic system.

As appears to result from the work of CAZALBOU and MOREL it is urgent to avoid all confusion until one has by all means arrived at a diagnosis and eliminated glanders. As regards the invasion of the body cavities it is rare, but still possible, and cases have been published by him (Jacoulet).

In the matter of surgical intervention associated with internal treatment everybody is in agreement with CHENIER.

VELU. **La lymphangite épizootique (Localisation.—Durée d'évolution.).** [Epizootic Lymphangitis. Seats of the Disease and Period of Evolution.]—*Bull. Soc. Cent. Méd. Vét.* 1916. Dec. 7; *Rec. Méd. Vét.* 1916. Dec. Vol. 92. No. 24, pp. 385–388. With 3 tables.

Between May 1913 and April 1915 the author treated 300 animals affected with epizootic lymphangitis at the veterinary infirmary at Casablanca. A careful account was taken of each case and various methods and products were employed in the treatment. In order to appreciate the results it was thought necessary to study the course of the disease according to the seat affected; for example, one might learn that lesions affecting the neck are relatively mild and run their course in six weeks no matter what treatment is adopted. The seats affected, the extension of the lesions, the length of treatment and average duration of the disease in the case of the various seats, are enumerated in the tables.

In 113 cases (or 37·6 per cent.) the disease developed on the trunk as the result of harness sores, and generally the corded lymphatics emanating from the affected wounds were directed towards the entrance to the chest; exceptionally (2·33 per cent.) they gained access to the precrural gland.

Lesions on the limbs represented only 19·33 per cent. of the cases treated. The hind limb was more often affected (35 cases) than the fore limb (23 cases). Invasion of the upper parts of the limbs was more frequent than extension along the whole limb (23 cases as against 12 for the hind, 18 as against 5 for the fore limbs).

The head was fairly often affected (16 per cent.), then came localisations on the shoulder (11·6 per cent.) and on the breast (7 per cent.). Neck lesions are rare (2·66 per cent.), as well as those of the lumbar region (2·66 per cent.), and genital organs (2·66 per cent.).

Lesions of the mucous membranes (sheath, vulva, nasal, conjunctival) remained the most refractory to treatment. All the animals recovered, but the average duration of treatment reached or exceeded four months.

Lesions of the withers are equally serious, inasmuch as they often involve the bony tissue and become complicated with chronic suppurations which evolve in about four months or necessitate destruction.

Localisations on the limbs were curable rather more quickly—in from three to four months on an average. Lesions affecting the hind limb are in fact more difficult to cure than those of the fore limb. The disease affecting the lumbar region, breast, and shoulder is less severe than that of the limbs, back, or sides, since it runs its course in less than three months.

Finally, localisations of the head (cutaneous) and neck are comparatively benign, since a cure can be brought about as a rule in six weeks.

(b) Sporotrichosis.

Davis (D. J.). **The Permeability of the Gastro-Intestinal Wall to Infection with** *Sporothrix schenckii*.—*Jl. Infect. Dis.* 1916. Nov. Vol. 19. No. 5. pp. 688–693.

In this article an account is first given of the literature dealing with the permeability of the mucous membrane of the gastro-intestinal tract to organisms of various kinds. The permeability of the mucous membrane to sporothrix organisms was investigated by feeding rats with cultures of typical *Sporothrix schenckii* isolated from the human subject, rats being highly susceptible to experimental inoculation. The cultures were ground up in a mortar and mixed with milk.

Tests were made to determine the length of time the Sporothrix remained alive in the stomach of the rat. At the end of two hours after ingestion the organisms could be seen and readily recovered by culture. At the end of three hours they could usually be recovered. At the end of four hours, in the case of four rats, the author could not detect the organisms in smear or in culture.

A number of animals died within a short period of time following the feeding; examination of the heart blood and other body fluids in these cases did not reveal any Sporothrix organisms. The history of 13 animals fed regularly over a period of several weeks or months is tabulated. It appears that only two of these animals showed on post-mortem examination distinct lesions of sporothricosis, as evidenced by nodules in the omentum, mesentery, and lymphatic glands. The organisms fed in these experiments had been previously shown to be highly virulent for rats by subcutaneous or intra-peritoneal inoculation.

The author quotes GOUGEROT, who fed rats and young guinea-pigs with cultures of *Sporothrix beurmanni.* Two rats were fed with large amounts of such cultures for six months; both animals became infected and after ten months one died and the other was killed; extensive sporothricotic lesions were found in both.

The author's summary is as follows :—

"White rats fed at intervals of a few days with large quantities of cultures of *Sporothrix schenckii* may become infected.

"The infection tends to localise in the mesentery, peritoneum, and spleen.

"The organisms appear to penetrate the normal mucosa of the intestinal tract. No lesions active or healed were visible in the mucosa or in the wall of the stomach or intestines."

MEYER (K. F.). **Notes on the Occurrence of Equine Sporotrichosis in Montana and the "Blastomycotic" Form of** *Sporotrichum schencki-beurmanni.*—*Proc. Soc. Exper. Biol. & Med.* 1916. Oct. 18. Vol. 14. No. 1. pp. 23–24.

"In 1915 I expressed the belief, based on very inadequate material, that animal sporotrichosis is found also in Montana. Quite recently, through the courtesy of Doctor Du Frene, of Glendive, fresh pus collected from a case of equine sporotrichosis was forwarded to me for diagnosis. Without the least difficulty a typical *Sporothrix schenki-beurmanni* was isolated on Sabouraud medium, and conclusive bacteriologic evidence was thereby obtained that sporotrichosis exists endemically in Montana.

"As is customary in our studies on fungi, plain one per cent. glucose agar was inoculated with the pus. The growth on this medium remained perfectly white and thin, becoming thick, moist, very stringy and inelastic in contrast to the typical well-pigmented folded film observed on Sabouraud's agar. The culture did not penetrate into the superficial layers of the agar, and was easily emulsified. It grew well under anaerobic conditions, and produced a rapid septicaemia in rats and rabbits. On one per cent. glucose agar and plain potato, this pleomorphism has remained so far (three weeks and four transplants) constant, but on Sabouraud medium the typical growth invariably appeared in a short time.

"Microscopically, such a culture consists of oblong, oval or round, short, monilia-like mycelia with a well-marked double membrane and refractile granules. Some round forms show reproduction by budding and aggregations in pairs or short chains. Long mycelia with typical clusters of spores were always absent. Macroscopically and microscopically these cultures appeared in every respect like yeast or saccharomyces.

"The 'blastomycotic' pleomorphism has been observed by Gougerot for the *Sporotrichum beurmanni,* but has never been described for the American strains. When transplanted on very moist and soft agar, I repeatedly noticed, for at least three to four days, the yeast-like character of some human strains isolated from cases in North America, but such cultures always returned to the typical growth within ten days.

"The tendency of a recently isolated strain of sporothrix to revert to its parasitic pleomorphism under unfavourable conditions (moisture, absence of oxygen, and carbohydrates) appears to be characteristic of the European

as well as of the American types, and clearly proves their close botanical relationship with the 'blastomyces.'

"Serologic tests have previously shown that complement fixation is regularly obtained with sera of infected or immunised animals when various yeasts are used as antigens."

BACTERIAL DISEASES.

DOLD (Hermann). **Vier weitere Fälle von natürlich erworbener bazillärer Dysenterie beim Hunde, nebst Beobachtungen über Bazillenträgertum.** [Four Further Cases of Naturally Occurring Bacillary Dysentery in the Dog, with Observations on the Carrier Problem.]—*Deutsche Med. Woch.* 1916. July 6. Vol. 42. No. 27. pp. 811–813.

In 1915 the author and FISCHER (W.) published the first confirmed case of bacillary dysentery in the dog. This occurred in a sporting dog kept in the neighbourhood of Shanghai and worked over ground where multiple opportunities for infection from human faeces arose owing to the lack of hygienic conditions among the natives. According to the sportsmen of the district dogs often passed mucous, blood-stained faeces in these parts.

Out of seven dogs, brought to the author for examination affected with diarrhoea, four were found to be infected with dysentery bacilli. A record of each of these cases is given, containing a history of the course of the disease, including the condition of the faeces; the results shown were obtained by microscopic examination of the faeces, cultivation on Endo plates, from the characters of growth of suspected colonies in the various test media, and from the agglutination titers of the strains obtained from each case against each of three different known agglutinating dysentery sera (Flexner, Shiga-Kruse, and Y, respectively). No opportunities for post-mortem examination occurred as the animals were taken back by their owners, and three out of the four affected cases recovered.

It was found that the four dogs affected with clinical symptoms of dysentery on bacteriological examination gave the following results :—

Case 1. Dysentery bacilli (Flexner type) and rare, not regularly found, amoebae and flagellates.

Case 2. Dysentery bacilli (Y type) and amoebae.

Case 3. Dysentery bacilli (Flexner type) and eggs of *Schistosomum japonicum.*

Case 4. Dysentery bacilli (Shiga-Kruse type).

The various types of dysentery bacilli were further tested as to their respective virulence by rabbit inoculation. In all four cases the serum of the dogs gave a distinct agglutination reaction against the respective types isolated from the faeces or from the blood (1 : 300, 1 : 100, 1 : 300, and 1 : 120, respectively).

"Case 4 was a pure bacillary dysentery as well as Case 3, for the *Schistosomum japonicum* could hardly have contributed towards the clinical symptoms. In Case 1 the amoebae, the pathogenicity of which was not determined, apparently were only of subsidiary importance inasmuch as they were very few in number and not always present in the faeces. In Case 2, in which the amoebae were numerous and constant, a mixed infection was possible; while the importance of the amoebae was not known the importance of the bacilli was apparent on account of the specific immune reaction of the serum of the infected animal."

The author next infected a healthy animal, the faeces of which were free from dysentery bacilli, with a culture of dysentery bacilli (Strain Y) by feeding. No clinical symptoms followed and the faeces of the dog remained normal in consistence, but dysentery bacilli could be isolated from them for a period extending over three months.

In order to determine the persistence of dysentery bacilli in the mouth and especially on the tongue a dog which had swallowed the bacilli was caused to lick Endo plates daily. It was found that dysentery bacilli could be isolated from the tongue for a period extending up to 13 days after infection.

VAN SACEGHEM (R.). **Etude sur des cas de dermite ulcéreuse des Equidés observés au Congo Belge.** [Ulcerative Dermatitis of Equines in the Belgian Congo.]—*Bull. Soc. Path. Exot.* 1916. Nov. Vol. 9. No. 9. pp. 675–679.

Several cases of specific ulcerative dermatitis were observed by the author especially amongst asses. Horses were equally susceptible but the lesions never assumed the pernicious character they did in the case of the donkey. The disease affected African as well as European breeds of asses.

A detailed account of three cases is given in which the lesions affected the breast, the knee, and the right side of the chest respectively. The last described ass also gave birth to a young animal which soon succumbed to the disease.

The lesions consisted of an ulceration of the skin, a necrosis of the underlying tissues with the formation of numerous fistulae, together with the presence around the ulcer of small very firm tumours which on section disclosed a characteristic oily pus. The disease remained quite refractory to treatment.

Clinically the disease resembled epizootic lymphangitis, but no cryptococci could be discovered in the pus. Glanders was eliminated by the mallein test. The bacillus of Preisz-Nocard could not be discovered and inoculation of virulent pus into sheep gave negative results. Smears from the oily pus of the lesions always showed the presence of small cocci, 0·5 microns in diameter, in the form of diplococci, or in masses, or in short chains. The organism grew well on serum in the form of short-chained streptococci.

Inoculation into guinea-pigs produced a firm swelling which later suppurated. A culture killed by heat injected into an affected ass produced a thermic reaction together with a marked local reaction. The author proposes the name *Dermatococcus congolensis* for this micrococcus.

In discussing this paper, BRIDRÉ mentions that in several cases of ulcerative lymphangitis in France he has been able to find a small Gram-negative micrococcus in a pure state, free or included in the leucocytes, in pus taken from unopened abscesses. He also notes that in the disease attributed to the Preisz-Nocard bacillus this bacillus was not found by NOCARD in all the horses he examined. In BRIDRÉ's cases the lesions always affected the hind limb, contrary to the dermatitis observed in the Congo asses by Van Saceghem.

DISEASES DUE TO ULTRA-VISIBLE VIRUSES.

(a) Foot and Mouth Disease.

Kallert (E.). **Untersuchungen über Maul- und Klauenseuche. IV. Mitteilung. Die bei Maul-und Klauenseuche im Pansen des Rindes auftretenden Veränderungen.** [Lesions in the Rumen of Cattle affected with Foot-and-Mouth Disease.]—*Arbeit. a. d. Kais. Gesundh.* 1915. Dec. Vol. 50. No. 2. pp. 159–163. With 2 plates (1 coloured) comprising 7 figs.

The importance of lesions produced in the rumen of cattle in foot-and-mouth disease is masked by the more obvious external lesions; on account of the possibility of secondary infection by absorption of bacteria and toxins from the decomposing contents of the rumen these changes, however, have a considerable influence on the course of the disease.

Naked-eye examination of the lesions reveals the presence of aphthae or blisters lying side by side in various stages of development. The smallest consist of brownish-red or dark-red slightly raised specks about the size of pins' heads; these increase in size until one sees irregular, raised, rounded or oval areas about ½ cm. in diameter. Transverse section shows that the raising of these patches is due to a marked exudation of blood between the layers of the epithelium.

Further changes consist in the shedding of the upper layer of the blister and this is probably soon effected owing to the movements of the stomach contents. The blood clot in the blister cavity is then removed showing the base of the blister, which is of a light-red or grey colour.

The most extensive formation of blisters takes place on the membrane covering the pillars of the rumen while none may be found in the region of the long papillae. The development of the aphthae must take place rapidly as all stages are found in animals slaughtered while suffering from the disease. It is presumed that healing takes place in the same manner as in the case of the skin lesions.

Microscopic alterations.—The author gives a description of the histology of the normal rumen epithelium. The commencing changes appear to take place by the rupture of the capillaries embedded in the papillae of the lamina propria or connective tissue layer. The extravasated blood appears to traverse through the deepest epithelial layer (stratum cylindricum) and infiltrate the next layer (stratum spinosum), which thus becomes destroyed and replaced with blood mixed with strands of epithelium.

This early haemorrhagic infiltration is therefore comparable to what one commonly finds in inflammatory diseases involving any part of the mucous membrane of the digestive tract.

The upper horny layer (stratum corneum) together with the underlying cellular detritus is soon lost through the mechanical action of the rumen contents. The base of the small ulcer is thus formed almost entirely from the connective tissue papillae, still covered with remnants of the destroyed epithelium, the layer of cylindrical epithelial cells (stratum cylindricum) showing a marked persistency.

Instead of being sharply circumscribed as in the case of the skin aphthae, the rumen lesions show another peculiarity in that while they are still intact the contained cellular detritus tends to infiltrate for some distance around and in between the layers of intact epithelium.

The author concludes that in foot-and-mouth disease the changes occurring in the rumen of cattle comprise typical blisters or aphthae which differ macroscopically and microscopically from the aphthae appearing on other parts of the body in a few particulars, especially in an influx of blood into the aphthae and an early loss of the covering epithelium.

(b) Fowl Pox.

Gallagher (B.). **Epithelioma contagiosum of Quail.**—*Jl. Amer. Vet. Med. Assoc.* 1916. Dec. Vol. 3. No. 3. pp. 366–369.

Epithelioma contagiosum (avium) or bird pox is stated to have been shown by recent investigators to be identical with avian diphtheria, the causal organism being capable of producing either the hyperplastic epithelial nodules characteristic of the former, or the croupous and diphtheritic pseudo-membranes on the mucous membranes of the head associated with the latter disease.

The outbreak observed by the author occurred in live quail which are imported in large numbers from Mexico into the United States for the stocking of game preserves. Four hundred birds were under observation and the mortality during a period of five weeks amounted to 85 per cent. The symptoms and lesions exhibited by affected birds consisted, in some cases, in the eyes only becoming infected ; in others, the diphtheritic exudate was found in the nasal passages and in the mouth. Most of the birds showed typical bird pox lesions on the skin especially of the wings and around the head, which had become more or less ulcerated during transit in crates. In many cases all lesions mentioned were present on one individual.

Transmission experiments.—In one series of experiments emulsions made from the quail pox nodules and also quail diphtheritic material from the mouth were spread on the lightly scarified surfaces of the combs and wattles of young fowls. In each case characteristic pox nodules developed at the points of inoculation after a period of 6–8 days. The lesions were, however, not so marked as those produced by artificial inoculation of chicken pox from fowl to fowl.

After rubbing the emulsions on to the oral mucous membranes, lightly scarified, of half grown fowls typical croupous patches appeared in seven days.

Two fowls inoculated intravenously with emulsion remained unaffected.

Experiments to determine whether the disease was produced by a filterable virus apparently all gave negative results.

(c) Rinderpest.

Boynton (W. H.). **Rinderpest in Swine, with Experiments upon the Transmission from Cattle and Carabaos to Swine and Vice Versa.** —*Philippine Agric. Rev.* 1916. Fourth Quarter. Vol. 9. No. 4. pp. 288–336. With 2 plates and 10 charts. 1916. Manila Bureau of Printing.

While working on rinderpest in the field in the Philippine Islands it had been noticed for many years that simultaneously with the appearance of the disease in cattle and carabao in certain localities pigs also became affected. Evidence that pigs played a rôle in the spread of rinderpest was especially brought forth in the course of an investigation into an outbreak of the disease causing serious losses among cattle in the island of Romblon, where previously the disease had never existed, and no cattle had been imported there for a long time ; it was found, however, that pigs had been imported from another island where rinderpest was prevalent and that first of all the pigs died in considerable numbers before the cattle and carabao began to die in a village.

Hitherto the disease had been overlooked in pigs as, owing to the prevalence of swine fever and other infestations, an unthrifty condition among pigs was very prevalent throughout the islands.

Pigs which had been hyperimmunised against swine fever in the laboratory in 1914, when exposed to cattle sick with rinderpest each developed symptoms similar to those caused by the disease in cattle.

Reference is made to the scanty and contradictory literature on the subject. CARRÉ and FREIMBAULT (1898), in Indo-China, demonstrated the possibility of transmitting rinderpest from pig to pig by contact and by blood inoculation, and also from bull to pig and from pig to bull by blood inoculation. LEBLANC (1886) found rinderpest among peccaries, and PENNING claimed to have transmitted the disease to wild boar. PLUNING noticed rinderpest in swine in Sumatra. THEILER claimed to have transmitted rinderpest to swine by inoculation of blood from cattle affected with rinderpest. JOBLING (1903), in the course of an experiment upon rinderpest in the Philippine Islands, inoculated a pig with 5 cc. of virulent rinderpest blood from a bull ; the pig developed typical symptoms of rinderpest ; a pig inoculated with blood from this pig did not develop symptoms of the disease, whereas a bull inoculated with the same blood developed typical symptoms of rinderpest, but ran a mild course of the disease, and on slaughter lesions of rinderpest were noticed.

The author then details a long series of experiments upon the transmissibility of rinderpest.

(1) The first series, in which pigs were exposed to cattle sick with rinderpest, consists of ten separate experiments. The pigs were exposed in two small stalls, the sick cattle being tied in these stalls while the pigs were unrestrained during the exposures. All the pigs used in the experiment had been kept in quarantine for a certain length of time, varying from 20 up to 76 days, their temperatures being taken twice a day and their daily physical condition noted. A history of the affected bulls is included in each experiment as well as the known history of each pig prior to the experiment.

It was found that all the pigs after exposure contracted a disease and developed symptoms characteristic of rinderpest in cattle and carabao. Three of the animals developed their initial rise of temperature on the 3rd day, four on the 4th day, one on the 7th day, one on the 8th day, and one on the 9th day of exposure. The incubative period of the disease in pigs thus corresponded very closely to that in cattle and carabao, in which it varies between 3 and 10 days.

Of the pigs used two died, four recovered but remained unthrifty and were killed, although under normal conditions these animals would undoubtedly have been allowed to live, and of these four one contracted swine fever. Three presented very mild symptoms, showing only a temperature reaction and recovering rapidly; these animals under field conditions would hardly have been suspected of being sick. One was bled to death for virulent blood, thus making the natural result uncertain.

The above ten pigs were exposed altogether to 19 cattle affected with rinderpest. Of these 19 cattle 14 died of rinderpest, three recovered, and two were bled to death for virulent blood, thus making uncertain the natural outcome of the disease.

The mortality among the cattle in these experiments was accordingly 73·7 per cent., as against 20 per cent. in pigs.

(2) In the second series, consisting of three experiments, pigs which had been kept in quarantine for a certain length of time were exposed to pigs affected with the disease contracted from cattle affected with rinderpest. Two of the animals developed a rise of temperature on the 4th day after initial exposure and one on the 5th day; two died and one recovered but was finally destroyed on account of its unthriftiness. The mortality in pigs exposed to rinderpest-affected pigs thus appears higher than that of pigs exposed to rinderpest-affected cattle.

(3) In the next experiment rinderpest is shown to have been transmitted from pig to pig by means of a caretaker. The author had previously shown that in the case of cattle and carabao the virus of rinderpest was in such a condition that it was unable to cause the disease after a corral had been freed from sick animals for 24 hours. The pig used in this experiment was put in a corral in which there had been placed ten days previously two pigs that had died of rinderpest and had also shown lesions of swine fever on post-mortem examination. The pig thus exposed did not contract rinderpest, but developed a rise in temperature and showed mild symptoms which were diagnosed as those of swine fever. Three weeks later two pigs showing acute symptoms of rinderpest which terminated in death were placed in a corral 50 yards away from this pig and looked after by the same caretaker. Nine days later the pig showed a rise in temperature and died four days afterwards showing typical lesions of rinderpest on post-mortem examination.

(4) In the next series of experiments two pigs were inoculated with virulent blood from two pigs affected with rinderpest. The first pig was inoculated with 10 cc. of virulent blood and showed a rise of temperature on the 3rd day and died on the 4th day without showing any marked lesions. The second pig was inoculated with 2 cc. of virulent blood from another rinderpest affected pig and showed an initial rise of temperature on the 3rd day and on the following days showed loss of appetite and diarrhoea, and then gradually recovered, but remained unthrifty; the disease is stated to have run a typical course of rinderpest.

(5) In the following series of experiments pigs were inoculated with virulent blood from cattle affected with rinderpest. Four pigs were thus inoculated with blood from four bulls respectively, the history of which is outlined in each experiment. Both the pigs used in the first two experiments after an incubation period of three days ran a severe course of the disease and died presenting typical lesions of rinderpest on post-mortem examination. The other two pigs did not contract rinderpest and it is concluded that as they were known to have shown

a high temperature and developed diarrhoea prior to being used in these experiments they had been rendered immune by means of a previous mild attack of rinderpest.

(6) In another experiment a quarantined pig was inoculated with a mixture of virulent blood from a bull and a pig, both affected with rinderpest. The inoculated pig developed a rise of temperature three days later and died on the 20th day, presenting well-marked lesions of rinderpest on post-mortem examination.

(7) A known non-infected pig was drenched with 50 cc. of virulent blood from a carabao. Four days later it showed a rise of temperature and on the 6th day it was bled to death for virulent blood to be used in immunisation work.

(8) A series of six experiments were next performed in order to demonstrate the transmission of rinderpest to cattle by exposure to affected pigs. The results of these experiments are not altogether conclusive.

In the first experiment a quarantined bull was placed in the same corral as two rinderpest-affected pigs for 15 and 12 days respectively; the bull remained unaffected. Inoculated later with virulent blood from a bull it died from rinderpest as the result of the inoculation.

In the second experiment a bull placed with an affected pig also failed to contract the disease but subsequently remained unaffected as the result of inoculation with virulent bovine blood.

In the third experiment a bull was placed in the same corral as two rinderpest-affected pigs for 16 and 11 days respectively; the bull remained unaffected. The bull was later proved to have been susceptible during the exposure as it contracted rinderpest when inoculated with virulent bovine blood.

In the fourth experiment a bull, previously kept under observation for 332 days, was exposed to infection from two pigs directly and one pig indirectly by means of a caretaker. These pigs all showed acute symptoms and died later, showing typical lesions of rinderpest. The exposure in each case lasted one, nine, and five days, respectively, or fourteen days from beginning to end. Two days after the end of the exposure the bull commenced to manifest symptoms which became subacute in character, until the animal died 23 days later, showing typical lesions of rinderpest on post-mortem examination.

In the fifth experiment a bull was exposed for four days to a pig showing subacute symptoms of rinderpest from which it later recovered; the bull remained healthy but was proved afterwards to have been susceptible by inoculation with virulent bovine blood.

In the sixth experiment a cow placed for four days in the same stall as an infected pig showed a rise of temperature six days after the first exposure, later developed typical symptoms of rinderpest, and was bled to death on the 10th day for virulent blood.

(9) In a series of four experiments cattle were inoculated with blood from pigs affected with rinderpest. All except one readily contracted the disease, the failure being noted in the case of a bull which was inoculated with only 0·5 cc. of blood. It is admitted that a much smaller quantity has been demonstrated to transmit the disease when virulent blood is taken from a sick bull.

(10) In another experiment it was shown that the potency of the virulent blood is not materially affected by mixing pig and cattle blood.

(11) Two experiments were performed in which cattle were drenched with urine from affected pigs. In one experiment a bull drenched with freshly collected urine contracted the disease, while the result was negative in the case of the other animal drenched with urine stored overnight.

(12) A carabao exposed to a couple of pigs affected with rinderpest developed the disease and later died showing lesions of rinderpest on post-mortem examination.

(13) In another experiment a carabao contracted rinderpest when inoculated with blood from an infected pig.

(14) Two further experiments showed that pigs will contract rinderpest when inoculated with virulent blood from a carabao. One of the pigs died from the disease while the other showed symptoms but gradually recovered.

(15) Four pigs were placed in separate stalls in a shed where cattle affected with rinderpest were kept and both pigs and cattle were looked after by the same man. Three of the pigs died of rinderpest while the other showed symptoms but recovered.

(16) In another experiment ten pigs which had recovered from rinderpest were again exposed to the disease by contact with affected animals. It was discovered that apparently a permanent immunity was conferred on them against rinderpest after recovery from one attack—at least, for practically two years.

(17) Pigs which had recovered from rinderpest were shown to be capable of becoming infected later with swine fever in the course of an experiment in which four pigs which had recovered from rinderpest were separately exposed to swine fever by contact with groups of pigs suffering from this latter disease. Two of the pigs died and two showed symptoms of swine fever, while all on post-mortem examination presented lesions of the disease.

(18) In the last series of experiments pigs hyperimmunised towards swine fever were shown to be capable later of contracting rinderpest. Seven pigs which had been inoculated with very large doses of virulent swine fever blood were separately exposed by contact to bulls suffering from rinderpest in varying degrees of severity. All the pigs showed quite marked temperature reactions and three of them more or less well developed symptoms, but none died. These results indicate that no immunity was conveyed against rinderpest by the swine fever virus "although the animals ran a milder course of the disease than has been usually witnessed in the laboratory."

The author sums up the results of all these experiments as follows :—

"It will be noted that cattle, carabaos and pigs vary but slightly in susceptibility to rinderpest, and that the disease can be transmitted practically as readily from one type of animal to the other, as among their individual kind."

[It is unfortunate that the existence of swine fever, especially in the case of the outbreaks among quarantined animals mentioned by the author, renders some of the experiments rather difficult to follow.—Ed.]

(d) Variolae.

Camus (L.). **La Vaccine généralisée expérimentale.** [Experimental Generalised Vaccinia.]—*Bull. Acad. Méd.* 1916. Oct. 31 & Nov. 28. (Report extracted in *Rev. Gén. Méd. Vét.* 1916. Dec. 15 and 1917. Jan. 15. Vols. 25 & 26. Nos. 300 & 301. pp. 632 & 38–39 respectively.)

"Generalised vaccinia is an affection characterised by an eruption of vaccinal pustules in places that have not been in contact externally with the vaccinia. The eruptions are provoked by a localisation of the virus carried by the circulation. This affection is exceptional in the case of man; its existence has been doubted by very competent medical men. Chauveau, in 1856, experimentally reproduced this exanthema in the horse by intravenous injection of vaccinia; since then all similar attempts on other species of animals have remained without result.

"Camus shows that the cause of these failures lies in the use of insufficient quantities of virus. Invariably one obtains generalised vaccinia when a sufficient quantity of virus is passed into the blood stream. In the case of a dozen rabbits he succeeded a dozen times in reproducing generalised vaccinia. An animal is shown bearing numerous pustules which appeared spontaneously after an injection of vaccinia. The exanthema first appears on the third day, and is confined to the natural orifices and the parts surrounding them. The buccal cavity, tongue, lips, nostrils, eyelids, the perineal region, and parts of the skin where naevi are found, are predilection seats.

"A calf and a monkey are exhibited, both affected with a marked spontaneous eruption of vaccinal pustules provoked by an intravenous injection of homogenous vaccine. . . .

"The aspect of this exanthema in the case of the monkey is incontestably as typical as that of the calf but one cannot fail to remark that the mucous membranes have been infected with as great an intensity as in the case of the rabbit. The eruption on the calf on the contrary resembles much more that of the dog, in which the mucous membranes remained intact and in which the numerous pustules are located almost exclusively on the skin."

Camus (L.). **A propos de la Vaccine Généralisée chez le chien.** [Generalised Vaccinia in the Dog.]—*C. R. Soc. Biol.* 1916. Nov. 18. Vol. 79. No. 18. pp. 1008–1009.

The author presents a dog which he claims to be affected with generalised vaccinia following the injection of a large quantity (3 cc. per kilo). of vaccine virus intravenously. The first eruptions appeared on the seventh day on the skin of the head and on the limbs, and on the following day a large number of minute pappules were found disseminated on the whole surface of the body.

The disease produced was peculiar in that the visible mucous membranes were nowhere involved. The disease caused only a very mild general disturbance.

CAMUS (L.). **La Vaccine Généralisée chez le cobaye.** [Generalised Vaccinia in the Guinea-Pig.]—*C. R. Soc. Biol.* 1916. Dec. 16. Vol. 79. No. 20. pp. 1108–1109.

A small guinea-pig which received 1 cc. of vaccine lymph intravenously showed a small pustule on the fourth day on the vulva; on the fifth day numerous eruptions were found on the buccal region, especially on the lips; on the sixth day the eruptions had become distinct and the edges of the nostril showed several while the tongue was covered with them.

In thus becoming localised on the mucous membranes the eruptions resembled those of the rabbit and of the monkey; on the other hand in the cases of the dog and the calf the mucous membranes are hardly ever affected.

GAUDUCHEAU (A.). **L'Immunisation variolique du singe.** [Variolar Immunisation of the Monkey.]—*Bull. Soc. Path. Exot.* 1916. Nov. 8. Vol. 9. No. 9. pp. 669–672.

The immunisation of the monkey by means of variola against vaccinia has recently been disputed by WURTZ and HUON, as well as by ROGER and WEIL. In this article the author records an experiment, carried out by him at the Vaccine Institute in Tonkin (French Indo-China), from which the following results were obtained.

The variola virus was obtained from an Annamite, and two monkeys (*Macacus rhesus*) were inoculated by applying the virus to extensive scarifications along the back; one of these died following the inoculation while the other presented a very marked exanthema. The virus was collected from this latter animal and inoculated into two other monkeys and two buffaloes. Pustules developed on the monkeys, but none on the buffaloes.

About a fortnight after inoculation with the variola the above three surviving monkeys were inoculated on the buttocks and on outside of the thighs with Jennerian vaccine (etherised vaccine on right side and ordinary vaccine on the left). Three control monkeys were inoculated in the same way. In the case of the variolised animals no eruption developed whereas in the case of the controls typical pustules were observed, developing more tardily where the etherised vaccine was employed.

The author believes that it is quite possible to perform such experiments without accidental contamination in the first place with cow pox. He mentions that a strain of variola was kept up for three years in his laboratory by means of 43 successive passages in the monkey; during this time the virus was tested on more than 100 bovines and rabbits, always with negative results.

In conclusion, the author states that in the case of the monkey as in the case of other animals susceptible to variola and vaccinia a real immunity is conferred by variola against vaccinia.

MISCELLANEOUS.

(a) PLEURO-PNEUMONIA OF GOATS.

MORI (N.). **Sulla profilassi e sulla cura della Pleuropolmonite essudativa delle capre.** [Preventive and Curative Treatment of Exudative Pleuro-pneumonia in Goats.]—*Moderno Zooiatro.* Parte. Sci. 1916. Dec 31. Vol. 5. No. 12. pp. 285–289.

The work of this author in connection with exudative pleuro-pneumonia of goats has already been referred to in this *Bulletin*, [Vol. 4, No. 4, pp. 179–181]. In the articles then extracted he claimed to have discovered the causal organism which he stated was an Aspergillus, difficult to isolate from the lesions, but growing quite readily afterwards on sub-culture. He also described the presence of very minute corpuscles found both inside the leucocytes and free-lying in the pleuritic exudate. These he identifies as the conidiospores of the Aspergillus.

The disease has recently caused very serious losses in Central and Southern Italy, where the mortality sometimes exceeded 90 per cent. It seems probable that the disease was introduced from Serbia by means of fugitives during the war; it has been found that the disease actually existed in Serbia and Albania before the arrival of the Serbian goatherds.

The author refers to the impossibility of transmitting the disease experimentally by contact and of reproducing symptoms similar to those of the natural disease by inoculation.

Although experimental infection seems difficult or impossible to realise the author recommends segregation or slaughter of infected herds, inasmuch as in two outbreaks investigated infection was strongly believed to have been introduced by means of infected he-goats brought in for breeding purposes. Infection by indirect contact, due to the inhalation of the conidiospores of the Aspergillus, would likewise be eliminated. Disinfection of infected sheds, etc., is prescribed.

Good results in the prevention and cure of the disease are claimed to have been obtained by the inoculation of goats with a specific product consisting of the abundant serous exudate found in the pleural cavities of affected animals; this is freed of the tissue elements contained in it and treated with toluol or ether.

(b) EXTERMINATION OF LOCUSTS.

d'HÉRELLE (F.). **Campagne contre les** *Schistocerca Peregrina* **en Tunisie par la méthode biologique (Avril–Juillet 1915).** [Campaign of Eradication of *Schistocerca peregrina* in Tunis by Means of the Biological Method.]—*Arch. Inst. Pasteur. Tunis.* 1916. Apr. 1. Vol. 9. No. 3. pp. 135–143.

Conclusion.—"As applied to Tunis the organisation of destructive measures against migratory acridians by means of the biological method would not incur heavy expenditure and would have as immediate results the destruction of the greater part of the swarms of locusts situated in desert and uncultivated areas where mechanical methods of destruction cannot be applied on account of distance, lack of labour, and difficulties of accessibility.

"By reducing the number of locusts in the cultivated areas—and that n a more radical manner the more numerous the infestations, which resolves itself into a question of personnel—the biological method applied in an intensive manner would facilitate to a very great extent the production of crops and prevent irruptions with certainty.

"On account of the considerable diminution in the number of locusts the expenditure necessitated for mechanical means of destruction would be greatly reduced; this diminution in the number of insects, by relieving the mechanical means of operation, would entail, in consequence, a reduction in the number of natives employed for these means, a very tangible advantage in Tunis for multiple reasons into which it would take too long to enter here."

BÉGUET. **Quatrième campagne contre les Acridiens (*Schistocerca peregrina* Ol.) en Algérie au moyen du *Coccobacillus acridiorum* d'Hérelle.** [Fourth Campaign against Locusts in Algeria by Means of d'Hérelle's Coccobacillus.]—*Bull. Soc. Path. Exot.* 1916. Nov. Vol. 9. No. 9. pp. 679–682.

Hitherto experiments in connection with the employment of d'Hérelle's method for the extermination of locusts in Algeria have been conducted by bacteriologists, but this year the possibility of its application being entrusted to laymen was recognised, while the bacteriologists only undertook the exaltation of the virus as well as the technique of preparation and spraying of virulent cultures. The locust invasion was especially serious in 1916 in Southern Oran, and some steppe country in this district was chosen for experiments.

The principle consisted in a very mobile body of men preparing the culture media themselves and receiving every day the exalted virus from the Pasteur Institute of Algeria. Details are then given as to how the broth was prepared in the field from concentrated products and inoculated with exalted virus. Twenty litres of broth could be prepared and sprayed each day while travelling about. One litre of a 36-hour culture was sprayed per hectare. The results of this campaign were briefly as follows:—

The coccobacillus produced an epizootic among locusts which, however, never led to the complete disappearance of the infected swarms. A marked destruction only took place when the experiments were performed a long time before metamorphosis occurred and when a large mass of insects all became infected on the day of the spraying.

The results were practically *nil* in alfa-grass districts where the pastures were too scanty. Propagation of the disease never extended appreciably for more than a kilometre from the direction followed by the locusts; a swarm moving through uniform country becomes sterilised. However, a veritable immobilisation of the sprayed swarms was produced even in cases where the epizootic assumed on great importance.

VELU (H.). **La lutte contre *Schistocerca peregrina* au Maroc en 1916 par la méthode biologique. Deuxième campagne d'expérimentation.** [Eradication of *Schistocerca peregrina* in Morocco in 1916 by the Biological Method. Second Experimental Campaign.]—*Bull. Soc. Path. Exot.* 1916. Nov. Vol. 9. No. 9. pp. 682–684.

The results of the preceding campaign in Morocco had shown that the conditions for success depended especially upon the season at which the infections took place, the most favourable time being when the insects lived in a compact mass, moved slowly, and when "acridiophagia," the principal factor in infection, was at its highest.

An account of the movements of locusts in Morocco is given. All the swarms which passed in a certain direction were found contaminated with the coccobacillus, and hence the author deduces that (1) it is quite impossible to exalt the virulence of the American strain of coccobacillus preserved *in vitro* since July 1915; and (2) the locusts born at the time of the passage of infected swarms are contaminated.

Large quantities of virulent broth were sprayed in certain districts and the following observations were made.

The most favourable time for the infections is at the end of the third stage of the young locust (12 day old). In such cases a mass of dead bodies up to 10 cm. in thickness was found in certain places.

When the fourth stage (12 to 20 day old locusts) is reached the propagation of the infection is much less certain. The sick locusts are then left in the rear of the swarm and die separated away from other insects, and are thus lost for purposes of contagion.

When the period of the last moult is reached the locusts are submitted to more and more stringent sanitary laws which bring about the automatic elimination of germ carriers.

The last stages of larval life are thus not favourable for the application of the method, especially in open country.

(c) Sulphur Dips.

Chapin (R. M.). **The Chemical Composition of Lime-Sulphur Animal Dips.**—*U. S. Dept. Agric. Bull.* No. 451. Professional Paper. 1916. Dec. 14. 16 pp. Washington, D.C.

This paper furnishes another contribution to the literature on the subject of lime-sulphur solutions. Some additional knowledge on the subject is claimed to be furnished in this paper inasmuch as the writer "has been able to develop some new methods of analyses which appear in several ways superior to former ones."

The general plan of investigation, involving the preparation of solutions according to different formulae and under different conditions with subsequent analyses and comparison of results, consisted in experiments regarding the effect of storage, effect of lime added after dilution, effect of varying lime-sulphur ratio, effect of varying period of boiling, effect of varying concentration, occurrence and relations of calcium sulphite, ratio of polysulphide to thiosulphate, lower polysulphides and the effect of excess of lime, and higher polysulphides and the effect of oxidation.

General conclusions regarding the chemical aspect of the problem are then given.

The practical applications deduced from the data presented by these experiments are detailed as follows:—

"The subject has been dealt with by a number of investigators primarily interested in the preparation of such solutions for horticultural spraying purposes. Some of the formulas so developed seem to have given entire satisfaction for the purpose for which they were intended and the dilutions at which the resulting products should be employed under various conditions have become so well established that any change in formula would be of doubtful practical benefit. It is quite otherwise with solutions intended primarily for the purpose of dipping cattle and sheep. The formulas in use are those prescribed by the Bureau of Animal Industry many years ago when uncertainty regarding possible chemical reactions and possible effects of the resulting compounds upon both animals and parasites very properly led to the use of formulas which should be certain and safe, even if somewhat uneconomical. The formula here to be suggested is proposed therefore solely for use as an animal dip. It may be termed the '8–18–10' formula; that is, 8 pounds of high grade commercial quicklime, 18 pounds of fine sulphur (either flowers or flour) with somewhat more than 10 gallons water, boiled to a volume of 10 gallons at the finish. The time of actual boiling should be one hour. The theoretical ratio between lime and sulphur will be met by this formula if the lime is 98·3 per cent. pure, therefore the formula as given is appropriate for preparing a solution for dipping sheep where any chance of an excess of lime must be avoided. If commercial hydrated (not air-slaked) lime is used the amount should be increased nearly one-third, say to 10·5 pounds. For dipping cattle the formula may be used on the basis of available calcium oxide if the analysis of the lime is known, or if not known the lime may safely be raised to 8·5 pounds, corresponding to 92·5 per cent available calcium oxide, possibly even to 9 pounds. The manipulation of the materials in the actual process of preparation has been described in a recent publication from the Bureau.*

"The finished solution, drawn off from the sediment should theoretically contain 18 per cent. (grams per 100 cc.) of sulphid sulphur, but probaby will contain somewhat less. It is, therefore, appropriate for dipping sheep at a dilution of 1 volume of concentrate to 9 or 10 volumes of water, and for cattle at a dilution of 1 volume of concentrate to 7 or 8 volumes of water. But in any event, since baths lose strength during dipping, it is very desirable to keep them at all times under control by means of a 'field test.'†

"The particular advantages of the above formula are, first, that it closely approaches the theoretical ratio, making allowance for impurities; second, it is as concentrated a product as can be prepared without conversion of thiosulphate to sulphite; and third, the figures are easily remembered and readily converted into the quantities of ingredients necessary to prepare a batch of any desired size.

"In deducing a formula for the preparation of highly concentrated proprietary solutions it is evident that the manufacturer must make a few trial runs with plenty of sulphur in order to establish the conditions which will uniformly yield the product he desires, analysis of which will then inform him by how much he may safely reduce the sulphur to allow for the formation of sulphite."

REPORTS.

ACCRA LABORATORY. **Report for the year 1915.** [MACFIE (J. W. Scott).] 101 pp. F'cap. With 6 plates. 1916. London: J. & A. Churchill.

This report contains a description of the routine work of the Accra Laboratory, Gold Coast; for the first six months of the year this was

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* IMES (Marion). Sheep Scab.—*U.S. Dept. Agric.*, Farmers' Bull., 713. 36 pp. 1916. Washington.

† CHAPIN (R. M.). A Field Test for Lime-Sulphur Dipping Baths.—*U.S. Dept. Agric., Bull.* 163. 7 pp. 1915. Washington.

undertaken by MACFIE while for the second half of the year a summary of the work done is given by BROHIER (S.L.).

In addition, a list of the special papers published in various journals by Macfie is given, some of which have already been extracted in this *Bulletin.* A considerable number of further special investigations of importance are given in this report, references to some of which are made elsewhere in this number.

With regard to the routine examination carried out at the laboratory the following tables, reprinted from the report, are of veterinary interest:—

Trypanosome Infections found in Animals Slaughtered at Accra, January to June, 1915.

Host	Number examined.	Number with trypanosomes in the blood.	Percentage infected with trypanosomes.	Number infected with		
				T. vivax.	*T. congolense.*	*T. pecaudi.*
Cattle, hump-backed ..	48	45	93·7	33	14	6
Cattle, straight-backed ..	27	3	11·1	2	1	—
Sheep	33	1	3·0	1	—	—
Goats	29	1	3·4	1	1	—
Pigs	33	2	6·0	—	1	1
Totals ..	170	52	30·5	37	17	7

Babesia Infections found in Animals Slaughtered at Accra, January to June, 1915.

Host.	Number examined.	Number with Babesiasis.	Percentage with Babesiasis.	Number infected with	
				B. (T.) mutans.	*B. bigemina.*
Cattle, hump-backed	48	22	45·8	20	3
Cattle, straight backed	27	12	44·4	10	2
Sheep	33	8	24·2	8	—
Goats	29	—	0·0	—	—
Pigs	33	—	0·0	—	—
Totals	170	42	26·4	38	5

Examinations of Various Animals.

Animal.	Number examined.	Infections found.	Animal.	Number examined.	Infections found.
Bats	3	None.	Fish ..	1	None.
Birds :—			Hedgehog ..	1	None.
Fowls ..	8	None.	Lizards (*Ag. colonorum*)	2	*Haemogregarina* sp. in one.
Parrot ..	1	None.			
Small birds	3	None.			
Turkeys ..	4	*Halteridium* sp. in one; and inclusions in the leucocytes in one.	Mice.. ..	14	None.
			Monkey ..	1	None.
			Rabbit ..	1	None.
			Rats :—		
			Brown ..	22	*T. lewisi* in two; *Grahamella* in four; *N. decumani* in four.
Cat	1	None.			
Crocodiles ..	3	*Haemogregarina* sp. in one.			
Dogs	4	*T. congolense* in one.	Pouched ..	4	*Grahamella* in three.
Equines : —			Snake ..	1	None.
Donkeys ..	1	*T. congolense.*			
Horses ..	10	Trypanosomes of *T. congolense* type in five.	Toads (*Bufo regularis*) ..	11	*T. rotatorium* in ten; *Haemogregarina* sp. in ten.
Mules ..	17	Polymorphic trypanosomes ? *T. equiperdum* in two.	Tortoise ..	1	*Haemogregarina* sp.

An account of the parasitic infections found in the course of examining blood films obtained from the Accra slaughterhouse was given in the Annual Report of the Accra laboratory for the year 1914 [see this *Bulletin*, Vol. 4, No. 2, pp. 81–83] and an account of the occurrence of babesiases and trypanosomiasis at Accra has been published in the *Annals of Tropical Medicine and Parasitology*, 1915, Vol. 9 [see this *Bulletin*, Vol. 4, No. 1, pp. 6–9].

For the second half of the year the examinations of the blood of animals from the slaughterhouse (by Brohier, S. L.) gave the following results as to the occurrence of trypanosomes :—

	Number examined.	Number infected.	Percentage.
Cattle	67	17	25·3%
Sheep	21	1	4·7%
Goats	22	—	—
Pigs	22	—	—
Totals	132	18	13·6%

" Examination of other animals.—Blood films from various animals were examined, but except in the case of 1 horse, 1 snake, and some rats, no parasites were found.

" The animals examined were 57 in number, viz., 1 pigeon, 1 cat, 1 dog, 1 duck, 1 horse, 3 hens, 1 cock, 1 sparrow, 1 bat, 3 snakes, 42 rats, and 1 hedgehog.

"Of the 42 rats examined six were found harbouring trypanosomes of the *T. lewisi* type, and three of the piroplasms alluded to in the last Annual Report as *Nuttallia decumani*.

"One case of equine filariasis was observed. The horse, the subject of this disease, was sent me by the police with a request for a report as to its fitness for work.

"The horse was emaciated; a watery discharge escaped from his nostrils; there was thickening and ulceration of the left lower eyelid at its inner angle, and a purulent discharge escaped from it. There was also a scanty purulent discharge from the right eye, but no signs of ulceration or of inflammation were present. The testicles were slightly enlarged and firm, the integument was thickened and honeycombed with shallow ulcers. Flies were constantly resting on these ulcers and apparently caused the unfortunate animal much discomfort.

"The coat was normal, but it was evident the animal had been greatly neglected, and several small shallow ulcers, mostly covered with scabs and abrasions were seen scattered over the body.

"An examination of the blood revealed numerous filarial embryos, very active, moving about with strikingly snake-like movements. No definite sheath could be made out, but the delicate transverse striation of the musculature of the body could be readily seen in specimens stained by dilute Giemsa. The anterior end was blunt, the posterior ending in a pointed whip-like tail. A definite clear space was noted between the anterior end and the commencement of the body nuclei; a clear collar-like space occurred about the point of junction of the anterior third with the posterior two-thirds of the body; and shortly behind the collar-like spaces a diamond-shaped orifice could be seen. A differential leucocyte count gave the following percentages:—polymorphs, 52%; large monos, 4%; eosinophiles, nil; large lymphos, 12%; small lymphos, 30%; hyaline and transit, 2%.

"Although examined for periodicity, none was apparent. The microfilariae were present in films taken in the day-time as well as in those taken at night; if anything the number was slightly greater in the films taken in the day-time.

"Ten days later the most noticeable feature was the presence of a large island of oedema over the most dependent parts of the abdomen, and the owner stated that when kept in the stall the legs became swollen. The testicles had greatly diminished in size, the integument was nearly normal, and the coat had greatly improved, though ticks were still found in the flexures and in the ears. The eye condition was, if anything, rather worse. Microfilariae were still present. Inoculations of the blood into guinea-pigs and rats were negative. At this stage the differential leucocyte count was as follows:—polymorphs, 68%; large monos, 2%; eosinophiles, 10%; large lymphos, 12%; small lymphos, 7%; basophiles, 1%.

"Some of the clinical features of this case were suggestive of trypanosomiasis, but no trypanosomes were found in the blood, although there was some degree of auto-agglutination of the red corpuscles in the specimens examined. It is impossible to say to what extent the symptoms described may have been due to filariasis."

BRITISH EAST AFRICA. **Department of Agriculture. Annual Report of the Veterinary Department for the Year ending 31st March 1915.** [STORDY (R. J.), Chief Veterinary Officer.]—pp. 115–124. 1916. Nairobi, British East Africa: Swift Press.

Diseases of Cattle. East Coast Fever.—Nine outbreaks occurred during the year. There are now 70 dipping tanks in good working order throughout the country, and the good results obtained by their use have convinced the settler community of the efficacy of regular dipping at three-day intervals as a preventive against East Coast fever. Several more dipping tanks are being constructed and the view is held that it is only by universal dipping that the suppression of East Coast fever can ever be anticipated. Some remarks on the forwarding of samples of dip for chemical analysis are included.

Rinderpest.—Twelve outbreaks of this disease occurred on European-owned farms. The disease is enzootic throughout most of the native reserves and owing to illicit movements of cattle from these reserves many outbreaks have occurred in the settled districts in the neighbourhood of these areas. It has been found possible to deal only with outbreaks affecting European-owned cattle. Double inoculation has thus been carried out on an extensive scale in many districts with most satisfactory results. The average mortality has been less than one per cent. More than 35,000 military cattle have been doubly inoculated since the war began.

230,384 doses of serum were sent out by the laboratory during the year, the greater part of which was exported to other countries.

Anthrax.—This assumed the form of an epizootic in two districts, the sudden increase of the disease being attributed to the shortage of grazing throughout the country resulting in cattle being compelled to graze closely and thus ingest considerable quantities of infected soil. 23,000 doses of anti-anthrax serum, prepared at the laboratory, were issued with most beneficial results. Unfortunately the vaccine in one case had regained its virulence and resulted in a number of animals succumbing to the disease.

Pleuro-pneumonia.—A recrudescence occurred in the Masai reserve in April. The cattle in five infected villages were quarantined, but the mortality was not large.

There were no cases of tuberculosis. Three outbreaks of blackquarter occurred and this disease appears to be on the increase.

Diseases of the Horse. Epizootic and *Ulcerative Lymphangites* were discovered in districts adjacent to the railway before the war. After the outbreak of war horses and mules were commandeered throughout the country and ulcerative lymphangitis was found to be existent among equines to a wholly unexpected extent.

Horse Sickness.—Fifty-six cases were reported and most of these occurred in Nairobi. The mortality from this disease has not been large for some years, and it is hoped that with better stabling of animals, etc., the death-rate will never reach the high percentage recorded in South Africa.

Sheep scab is ubiquitous, and while the hairy native sheep suffers little the causal parasite has disastrous effects on the wooled animal.

Goats.—Pleuro-pneumonia is widespread in the native reserves.

Pigs.—In order to eliminate the danger of infection with swine fever from wild porcines several farms have fenced their pig runs with wire netting.

" There is no country in the world where pigs can be reared so cheaply, and pig breeding is rapidly becoming one of the most lucrative industries of the Protectorate."

Dogs.—No cases of rabies occurred during the year.

Ostriches.—Castration was undertaken by the Veterinary Department.

Poultry.—Kikuyu fowl disease, an extremely acute form of fowl cholera has been the cause of large mortality in different parts of the country.

Details are added concerning the permit system, which acts as a check on the movement of native cattle, live stock importations, meat inspection, trading, and branding of stock; also an account of the co-operation of the Veterinary Department with the Military authorities since the outbreak of war is given.

BRITISH EAST AFRICA. **Department of Agriculture. Annual Report of the Veterinary Bacteriologist for the Year 1914–1915.** [MONTGOMERY (R.E.).]—pp. 125–145. 1916. Nairobi. British East Africa: Swift Press.

The routine work of the laboratory consisted in examinations of slides and smears received from government officials and private owners, and in serum and vaccine preparation. The latter part of the work included the preparation of anti-rinderpest serum (274,368 doses), anthrax vaccine (32,180 doses), blackquarter vaccine (9,400 doses), colon bacillosis vaccine (701 doses), ulcerative lymphangitis vaccine (2,923 doses), and canine trypanblau (269 doses).

Diseases under Observation.

Anthrax.—See report of Chief Veterinary Officer.

Trypanosomiasis.—160 cases of the disease were diagnosed (105 in cattle, 52 in equines, and 3 in dogs). This represents a large increase over previous years and is due to the greater movement of susceptible animals within the areas inhabited by the tsetse fly. Large numbers of military animals were available for experimental treatment. The author believes that the number of diseases grouped under the name of trypanosomiasis or fly disease in the Protectorate is at least ten, the causal agents of which are distinct from a zoological point of view, and they differ in that recovery from the disease due to one type of trypanosome does not confer immunity against infection by another. Experiments were conducted with such drugs as 606, galyl, atoxyl, soamin mercury, tartar emetic, and arsenic in various forms and various combinations. No good results whatever were obtained, animals which had apparently recovered being still infective. HOLMES's method of treatment for Indian surra was applied in the treatment of a number of cases, but not one recovered.

Helminthiasis.—Experimental work on the wire worm infection of sheep appeared to show that land will remain infective for at least 12 months after the removal of all sheep, and also that sheep may retain worms in their stomachs for at least six months although fed with artificial foods.

Considerable mortality has been experienced among cattle and these, on post-mortem examination, were found to contain a large number of worms in the fourth stomach. Experiments are being carried out to determine whether the infection of cattle is identical with that of sheep. Lysol has given the most uniform results in treatment; the dose now given is 8 ozs. of a 5 per cent. solution administered in the form of a drench on four successive mornings.

A worm invasion of the stomach of equines due to the genus Spiroptera was frequently encountered and it is believed that lysol administered in these cases produces a marked amelioration in the condition. Donkeys were especially found infected.

Oesophagostomum columbianum appeared to be the cause of serious mortality in young sheep in the case of one outbreak.

Diseases affecting Equines.

Ulcerative lymphangitis, due to the Preisz-Nocard bacillus, was diagnosed in 83 cases, the symptoms varying in intensity from an insignificant pustule to abscesses covering the whole of the body. On the Uasin Gishu plateau, where the disease is prevalent, it commences with the formation of one or more abscesses around the fetlocks, more particularly on the hind legs and spreads upwards towards the thighs and over the body, and in cases which end fatally internal abscesses about the size of a child's head are often found situated near one or both kidneys. In chronic cases a peculiar scab-like formation resembling a warty growth forms on the localised abscesses and microscopic examination of these scabs invariably revealed the presence of a streptothrix organism.

Successful results were claimed to have been obtained in the laboratory following treatment by means of weekly injections of a vaccine made from the Preisz-Nocard bacillus. A large quantity of this vaccine, however, when tried in the case of an outbreak of the disease in a certain district, failed to give satisfactory results.

Epizootic lymphangitis.—Thirty-one military animals were available for experimental treatment and over 20 privately owned animals and mules. The disease appears to be confounded with the last described disease due to the Preisz-Nocard bacillus. The results of treatment with "606" were good, but the expense of this drug makes it prohibitive except in exceptional cases. Mercurial cream failed to give the good results hoped for. The administration of potassium iodide either alone or in combination with biniodide of mercury yielded results which left little to be desired. In order to ensure success animals must receive a dose every day for approximately a month. The routine practice employed consists in the administration of half an ounce of potassium iodide and 5 grains of biniodide of mercury each morning in the drinking water, the supply of green grass and water being curtailed until the full dose has been drunk. Even in advanced cases of the disease a marked drying of all lesions is apparent after about the seventh dose. The thickening of the lymphatic cords decreases, nodulation disappears, and, in about a month, the animal, unless in a very advanced stage at the commencement, will fail to show any outward trace of the disorder.

Infectious Anaemia.—This disease is strongly suspected as being the cause of heavy mortality among donkeys and experiments are in progress in order to determine whether this is the case.

Horse Sickness.—"That true Horse Sickness does exist in East Africa is clear but the results which have been obtained by Sir Arnold Theiler with specimens of blood forwarded to him for experiment demonstrated that only a percentage of the suspected cases are affected with it."

Diseases of Cattle.

Rinderpest.—No experimental work was performed during the year; the manufacture of anti-serum has been referred to above. The virulent blood used in the double inoculation had to be maintained in the laboratory, and either used within 48 hours of dispatch or an infected susceptible animal was forwarded and its blood employed for the immunisations.

East Coast Fever.—With the establishment of dipping this disease no longer calls for much further experimentation, for if an owner regularly dips in a dipping fluid of standard strength his losses even during the first year will be very considerably reduced and after that period it is probable that all infected ticks will have been eradicated.

Statistics are given with regard to the cost of dipping, etc. During 12 months' use 41,712 cattle, 2,608 equines, and 5,914 sheep and goats were passed through the laboratory dipping-tank. The total amount of dipping fluid used was 27,586 gallons. WATKIN-PITCHFORD's laboratory formula was adopted in the manufacture of the dipping fluid. Each 100 gallons for the three-day dipping thus contained :— Arsenite of soda (80 per cent. arsenic) 1 lb., soft soap $\frac{3}{4}$ lb., paraffin 2 lb. The cost of material worked out at 55·9 cents. per animal per annum.

Redwater and anaplasmosis.—Although dipping will eradicate both these tick-borne diseases from a farm it was sometimes found necessary to expose imported and other highly susceptible stock to areas which it had not yet been found possible to cleanse. A strain of anaplasma obtained from THEILER for the purpose of immunising such animals was found to be too strong to be tolerated with safety. With each successive passage the strain appeared to become markedly increased in virulence.

The blood of Uganda cattle was found to contain the causal organism of both redwater and anaplasmosis, and when inoculated into susceptible animals in doses of cc. induced a mild infection with redwater between the 8th and 12th day and anaplasmosis between the 20th and 50th day. The former reaction, if severe, was easily checked by means of trypanblau. It was noticed in the case of cattle from South Africa that the (second) reactions occurred between the 20th and 30th day, whereas in the case of stock from England the earliest reaction began on the 36th day and the latest on the 53rd day.

Of 15 shorthorns imported from England and immunised against rinderpest, redwater, and anaplasmosis by a single injection of Uganda blood in which the rinderpest virus was present, two died from anaplasmosis, the reactions to redwater and rinderpest being normal. Of four South African cattle immunised in the same way one died from anaplasmosis.

Colon bacillosis.—A vaccine made from the incriminated organism was issued to a number of stockowners for tests in the field, the method consisting in the injection of 5 cc. of emulsion containing 2,000 million of dead bacteria subcutaneously as soon after birth as possible. Reports were received which seemed to indicate that strikingly beneficial results have been obtained.

Blackquarter.—This disease had become more prominent during the year ; 5,000 doses of a single vaccine were issued and in most cases it was claimed that the vaccination was responsible for checking the mortality. In one instance a considerable number of calves succumbed to infection following inoculation, although the vaccine in this case had apparently been rigidly tested prior to issue.

Contagious abortion.—This occurs on several farms, but no increase has been noted. The agglutination test has been employed in diagnosis.

Disease "C.H."—In the course of an epizootic resembling a mild outbreak of rinderpest a specimen of blood was tested and shown to be capable of infecting cattle immune from rinderpest, and that susceptible animals recovered from this disease might still be infected with rinderpest. The symptoms manifested were dulness, slight depression, and a high temperature lasting three or four days, accompanied with a dark foetid diarrhoea which later changed to constipation. There was some discharge from the eyes and occasionally the membranes of the mouth were somewhat inflamed. In calves the inoculation produced a more severe reaction than in adults. In Indian buffaloes the reaction produced was more severe than in calves and the affected animals showed such extreme depression that death appeared imminent although all recovered. Mules were found to harbour the virus in their blood from about the 6th to the 10th day after inoculation, although no symptoms were shown; five animals out of 43 inoculated died.

One attack of the disease confers an immunity which lasts three months. The virus appears to live in the blood corpuscles, serum is not virulent and the organisms do not appear to pass through either a Chamberland or a Berkefeld filter. Defibrinated blood loses its virulence in about a week. Attempts to reproduce the disease by contact failed. An anti-serum was made by hyper-immunising cattle with large doses of virulent blood.

Diseases of Sheep and Goats.

Nairobi sheep disease.—This has been responsible for considerable trouble at some of the military supply camps. It was proved that ticks of the species *Rhipicephalus appendiculatus* can transmit the infection as adults, after having been fed as nymphae on a sick animal.

Pleuro-pneumonia in goats.—This occurred in the form of a serious epizootic throughout the Protectorate in September 1914. It was possible neither to ascertain the causal organism, nor experimentally to infect healthy animals.

Diseases of Pigs.

Swine fever.—No outbreak of the East African form of the disease was reported during the year. The Uganda bush pig was shown to be immune to this disease; owing to the devastation caused by these animals in the native habitations an attempt at eradication had been made by trying to transmit this infection to them.

Diseases of Poultry.

Kikuyu fowl disease.—109 cases of this disease were diagnosed in the laboratory. Although the causal organism differs from that of fowl cholera it resembles it in that its virulence becomes lost with age. The preparation of a preventive vaccine was therefore made possible, but this has not yet been extensively applied in the field.

MUKTESAR LABORATORIES. **Annual Report of the Imperial Bacteriologist, for the Year ending 31st March 1916.** [SHILSTON (A. W.), Assistant Bacteriologist in charge]. 23 pp. 1916. Calcutta: Superintendent Government Printing. India. [Price 5*d.*]

This report deals with (1) administration, (2) preparation of sera and vaccines, (3) research work. Tables are appended showing the quantities of different products issued from the laboratory, and the main results of the working of the laboratory for the year.

Under the heading of preparation of vaccines a number of figures are given which are specially valuable on account of the very large scale in which these products were employed. Tables are given showing the number of outbreaks, etc., dealt with by the administration of these products in the various provinces. The table on the following page gives a résumé of the total results achieved.

The other products manufactured were anti-strangles serum and vaccine, mallein, a small quantity of tuberculin, and small quantities of various miscellaneous vaccines.

The results of examination of specimens received are given.

Research work.—Some general remarks are given with regard to this part of the work ; no details are entered into, but the publication of the results of experiments is promised with regard to (1) observations on the preservation of rinderpest virus, (2) the immunising effect of dead vaccines in the case of anthrax and haemorrhagic septicaemia, and the standardisation of the anti-sera of these diseases [MACALISTER (G. H. K.)], (3) kumri, (4) the causal organism of abortion amongst mares and donkeys, (5) investigation of the transmission of surra by biting flies (HOWLETT).

Investigations into the drug treatment of rinderpest have been discontinued owing to the invariably unsatisfactory results obtained. It is stated that the value of both anti-serum and vaccines in the treatment of strangles among horses at two Army Remount Depots was frequently demonstrated.

The results of experiments performed with the object of increasing the output of serum and effecting economies in the course of its production have already been referred to in this *Bulletin* [see Vol. 4, No. 4, pp. 188–190 (NORRIS, R. V.)].

NIGERIA. **Annual Reports of the Agricultural Departments of Nigeria for the Year 1915.** 13 + 11 pp. 1916. Lagos : Govt. Printer. [Veterinary Report for the Year 1915.] [BRANDT (F. R.).] Appendix 1. pp. 5–7.]

On account of small staff employed the work has been rather limited, and has consisted mainly in tours with the object of instructing native cattle owners and obtaining information with regard to stock, grazing, water, and movements.

Rinderpest.—This appears to be the most important disease, but the mortality sometimes seems to be exceptionally low, varying from 5 up to 50 per cent., the latter figure being exceptional. Cases were seen in the early part of the year in Kano, Bornu, and Bauchi. It was found to be widespread in Sokoto Province as well as in French West Africa, where the disease appeared to be assuming a more virulent type. In June it was found to be again prevalent in Bauchi. In July the disease was found to have extended down the left bank of the Benue River to Muri.

No report of an outbreak of the disease was received during the latter part of the year. The disease thus followed a course which would lead one to suspect the possibility of its having been present for a long time in an endemic form, but of a character so mild as to have been

MUKTESAR LABORATORIES.]

Table showing results of use of serums and vaccines issued from the Muktesar Laboratory.

Serum or Vaccin.	Number of outbreaks in which inoculation undertaken.	Number of animals which died un-inoculated in course of disease.			Number of animals inoculated.			Number of animals which died after inoculation.		
		Equines.	Bovines.	Others.	Equines.	Bovines.	Others.	Equines.	Bovines.	Others.
Anti-rinderpest serum ..	2,662	*Nil*	43,058	168	*Nil*	396,293	1,184	13*	2,765	6
Haemorrhagic septicaemia serum and vaccin ..	518	1	2,769	*Nil*	7	89,641	14	*Nil*	76	*Nil*
Anti-anthrax serum ..	118	33	861	401	769	12,541	558	1	27	*Nil*
Blackquarter (Charbon symptomatique) vaccin ..	94	*Nil*	274	*Nil*	*Nil*	9,168	*Nil*	*Nil*	14	*Nil*

* This is apparently an error.

overlooked by the stock owners until 1914, when by a slight increase in virulence a high death-rate resulted. The natives, however, state that this is the first time that the disease has appeared since the outbreak of about 25 years ago.

No inoculations seem to have been performed.

Pleuro-pneumonia.—Prevalent throughout the country.

Foot-and-mouth disease.—Is widespread but the mortality is not high.

Anthrax and *Blackquarter* appear especially towards the end of the dry season.

Trypanosomiasis.—Is found in every province, but is not extensive in the northern stock-raising areas, where most of the fly belts are known and avoided as much as possible.

NIGERIA. **Annual Report of Medical Research Institute 1915.**— [CONNAL (A.) & SINCLAIR COGHILL (H.).] 28 pp. f'cap. 1916. London: Crown Agents for the Colonies. [Price 2*s.* 6*d.*].

The following paragraphs of veterinary interest are reprinted from this report :—

Babesiasis.

"By the request of the Principal Medical Officer, a number of blood smears from domestic animals were sent to the Institute to be examined for the presence of babesiae." . . .

"In all, the blood of 332 animals was examined. Babesiae were noted in 10 out of 168 cattle, in one out of 66 goats, in eight out of 44 sheep and in three out of 21 dogs; no babesiae were observed in 28 pigs, four horses and one cat." . . .

Blood-sucking Flies.

"The insects enumerated were all obtained in the immediate neighbourhood of Yaba.

"Three specimens of *Glossina palpalis*, females, and two of *Stomoxys nigra* were caught in the laboratory in April.

"During May *Glossina palpalis* 18 ♀, *Stomoxys nigra* 8 ♀, *Tabanus secedens* 3 ♀, *Stomoxys omega* 2 ♀, *Tabanus socialis* 2 ♀, *Hippocentrum versicolor* 2 ♀, *Tabanus thoracinus* 1 ♀, and *Tabanus fasciatus* 1 ♀ were obtained." . . .

"During June *Glossina palpalis* 10 ♀ were taken, also *Stomoxys nigra* 28 ♀, *Stomoxys omega* 2 ♀, *Tabanus secedens* 1 ♀, *Hippocentrum versicolor* 1 ♀ and *Glossina tachinoides* 1 ♀." . . .

"In July *Glossina palpalis* 11 ♀ were captured, also *Mansonioides africanus* 4 ♀, *Anopheles costalis* 1 ♀ and *Anopheles mauritianus* 1 ♀.

"Only *Glossina palpalis* 1 ♀ was obtained in August, but three were taken in September, as well as one female specimen each of *Tabanus socialis* and *Tabanus taeniola*.

"During October, *Glossina palpalis* 3 ♀, *Tabanus taeniola* 4 ♀ and one *Tabanus socialis* ♀ were captured.

"In November there were *Glossina palpalis* 1 ♀, *Tabanus taeniola* 3 ♀, *Tabanus par* 1 ♀, *Tabanus kingsleyi* 1 ♀ and *Tabanus secedens* 1 ♀, and in December one female *Glossina palpalis* was caught.

"The total blood-sucking insects caught and identified was 535, and of this number 320 were dissected and examined.

"Smears were made of (*a*) proboscis, (*b*) cephalic muscles, (*c*) thoracic muscles and (*d*) intestinal tract. In most cases these smears were examined in the fresh as well as in the stained condition.

"During the earlier period of the investigation attempts were made to feed the insects, particularly the glossina, on clean guinea pigs, but this procedure was soon given up as it occupied too much time, and also because many insects which would not feed on the day on which they were caught were found dead next day and therefore had to be discarded altogether.

This occurred most commonly in the case of the glossinae, and the inference was made that these flies were not locally hatched, but had come with the trains (which pass close to the Laboratory) and were spent and bruised by their journey.

"Smears were examined from 47 *Glossina palpalis*. Trypanosomes were found in the proboscis of two and in the stomach of another two. Spirochaetes occurred in one. Mammalian red blood cells were noted in the stomach of five, avian red cells in one, and filarial embryos were observed in one of the five that had ingested mammalian blood. The remaining 37 insects showed nothing noteworthy. The trypanosome-infected flies were caught one in April, two in June and one in November.

"One specimen of *Glossina tachinoides* was examined with negative results.

"Smears from 18 *Stomoxys nigra* and from four *Stomoxys omega* were examined. The only interesting result was the findings of avian red blood corpuscles in the stomach of one *Stomoxys nigra*. These insects, however, were caught mostly newly hatched from the garden manure.

"Specimens of seven species of Tabanus, *T. taeniola* (8), *T. secedens* (5), *T. socialis* (4) and one each of *T. par*, *T. fasciatus*, *T. kingsleyi* and *T. thoracinus*, a total of 21 were dissected. Herpetomonas were observed in the intestinal tract of one *T. secedens*.

"Two specimens of *Hippocentrum versicolor* showed nothing of interest." . . .

"Trypanosomes were found in four specimens of *Glossina palpalis* (47 examined).

"Herpetomonas were noted in the intestinal tract of three *Culiciomyia nebulosa* (112 examined), one *Ochlerotatus nigricephalus* (31 examined) and one *Tabanus secedens* (five examined).

"Spirochaetes were observed in three *Culiciomyia nebulosa* (112 examined), one *Mansonioides africanus* (23 examined), one *Ochlerotatus irritans* (22 examined), and in one *Glossina palpalis* (47 examined)." . . .

"The trypanosome-infected glossinae were caught in April, June and November. The spirochaete-infected glossina was caught in June, the culiciomyiae, the Mansonioides and the ochlerotatus in May. The filaria-infected culiciomyia and the anopheles were both caught in May." . . .

"Mammalian blood had formed the meal in five *Glossina palpalis*, twelve *Anopheles costalis*, one *Anopheles mauritianus*, six *Mansonioides africanus*, seven *Culiciomyia nebulosa*, 17 *Ochlerotatus nigricephalus*, 10 *Ochlerotatus irritans*, one *Stegomyia fasciata* and one *Stegomyia luteocephala*.

"Avian blood had been ingested by one *Glossina palpalis*, one *Stomoxys nigra*, and 27 *Culiciomyia nebulosa*.

Both mammalian and avian erythrocytes were found in the stomach of two *Culiciomyia nebulosa*, one *Anopheles costalis* and one *Stegomyia luteocephala*.

"It would appear from these results that *Culiciomyia nebulosa* prefers avian to mammalian blood." . . .

Trypanosomiasis.

"Many of the blood smears from domestic animals showed trypanosomes, cows, sheep, goats, horses, pigs and dogs were all found infected.

"Cattle and horses appear to be especially prone to the disease, probably because they are more frequently to be found outside the immediate environs of a town or village than the other animals, and so are more exposed to the bites of tsetse.

"Blood smears from 168 cattle were examined. They were all sent to the Institute in the dried state. Trypanosomes were found in 49, that is 29·1 per cent. So far as could be judged most of the parasites were *T. vivax*, and a few resembled *T. pecaudi* (*T. brucei*).

"A single goat out of 66 examined showed trypanosomes, the parasite resembling *T. vivax*.

"Forty-four sheep were examined and trypanosomes were found in one, the species being apparently *T. vivax*.

"Three pigs out of 28 were found to harbour trypanosomes, resembling *T. pecorum* (*T. congolense*).

"Blood smears from 21 dogs showed trypanosomes of the *T. pecaudi* (*T. brucei*) type in two cases.

"Four horses were examined and trypanosomes of the *T. vivax* type occurred in two.

"One cat was examined, with negative result.

"The infection was mostly a heavy one in the cattle, horses and dogs, and a scanty one in pigs, sheep and goats." . . .

"Various blood smears from 23 snakes, mostly harmless green or brown colubrines, were examined in a search for the pigment-bearing parasites which have been described from a few of the cold-blooded animals. Haemogregarines were found in six. Haemoproteus or plasmodia were not found in any, although in two of the animals a few of the leucocytes contained pigment granules.

"Other cold-blooded animals examined were 3 fish, 2 frogs, 1 toad, 1 crocodile, 1 turtle and 4 small tortoises. Parasites were only found in one animal, the turtle, and these were haemogregarines.

"A variety of other animals was examined. Out of nine different birds, one, a small heron, harboured trypanosomes. Ten mice showed no blood parasites. Out of seven rats, *T. lewisi* was noted in four and *Grahamella* in one.

"Seven monkeys, 4 bats, 2 pottos and 1 porcupine were examined with negative results." . .

Vaccine Lymph.

"The following experiments were carried out at the request of the Director of the Medical and Sanitary Service with the object of ascertaining whether there would be any danger in employing cattle, suffering from an infection of trypanosomiasis or babesiasis, in the manufacture of small-pox lymph; in other words, whether or not these parasites in some latent form or other could be transmitted to people vaccinated with lymph prepared from cattle harbouring these same parasites.

"After several visits had been paid to the cattle market at Ebute Metta, two young cows were finally chosen—one infected with trypanosomes and the other with babesiae.

"Three attempts were made to vaccinate these but without success, Dr. Mackey kindly helping on the first two occasions. Finally both animals died. Again two similar cows were procured and a fresh supply of lymph was tried; this met with success and after some difficulty lymph was taken from both. Owing to the weak condition of these animals they had to be allowed a good deal of liberty, and the difficulty arose how to prevent them from rubbing or scratching themselves and so rendering the experiment useless as far as they themselves were concerned.

"Two monkeys, whose blood had previously been examined, were vaccinated successfully with this lymph. After the first day their temperatures were taken morning and evening every second day for three weeks and at irregular intervals following. Two months afterwards their blood was examined for the last time. No parasites of any sort were found, and their temperatures were normal throughout.

"A portion of the lymph was examined microscopically, and also added to the water of condensation of three agar tubes. The result in both cases was negative."

PUNJAB. **Annual Report of the Camel Specialist for the Year 1915-1916** [CROSS (H. E.).]—27 pp. f'cap. 1916. Lahore: Superintendent. Government Printing. Punjab.

This interesting report commences by giving tabulated summaries of the mortality returns sent in by the various Camel Corps under observation; as the author states, too much reliance cannot be placed on these returns as they were compiled largely from the statements of camelmen, yet they give a very good idea as regards the relative prevalence of certain camel diseases.

The total losses from deaths, and castings amongst the eight Silladar Corps, four Grantee Camel Corps, and the Local Transport, Dera Ismail Kahn, Bannu and Kurram Valley Militia were 2,800 = 25·4 per cent., whereas the total losses from deaths alone were 2,500 = 22·7 per cent.

The most noteworthy disease was surra; the number of cases diagnosed during the year was 1,593, and it is considered that the number in reality considerably exceeded this figure owing to the disease in various forms, especially when accompanied by brain symptoms, being wrongly diagnosed.

Experimental Work.

Anti-fly emulsion experiments.—Details are given with regard to experiments conducted in smearing or spraying camels with various emulsions in places where surra was known to exist and where blood-sucking flies were prevalent.

The conclusions with regard to these various experiments are reproduced as follows:—

Creosol emulsion. Consisting of creosol, 1 oz.; pix liquida, 2 oz.; soft soap, 8 oz.; water, 3 pints.

"(1) Three pints of this emulsion are scarcely sufficient.

"(2) If the animals are kept in the shade the emulsion would appear to have some slight efficacy in warding off the attacks of Tabanidae.

"(3) After 12–13 hours the emulsion did not prevent the Tabanidae from biting.

"(4) If the animals are sprayed and kept in the sun the emulsion prevented Tabanidae from biting for half an hour only.

"(5) As soon as the emulsion has dried on the skin it does not appear to have the slightest efficacy against the attacks of Tabanidae."

Jensen's emulsion. (Kerosene oil, 1 gall.; powdered naphthaline, 4 ozs.; soap, 1 lb.; water, 4 galls.). At the time when these experiments were carried out the camels had little or no hair, and the sun was very powerful.

"(1) This emulsion prevents Tabanidae from biting for 12 hours.

"(2) The emulsion cannot be recommended for camels as it causes severe blistering of the skin."

Citronella oil. "This prevents Tabanidae and Stomoxys from attacking for a few hours, but it has no repellent action after 17 hours."

Cod-liver oil. "This does not prevent Stomoxys and Tabanidae attacking camels."

Aniseed oil. "(1) Tabanidae appeared on the sprayed and unsprayed camels at the same time. Aniseed has no repellent action against Tabanidae 2½ hours after application.

"(2) It has a slight repellent action against Stomoxys; the length of time it prevents Stomoxys from biting is so short that the oil cannot be considered to be of any practical value in warding off the attacks of the biting flies.

"(3) The application of only one pint causes great restlessness in the camel."

Castor oil. Four separate experiments were performed with castor oil and castor oil emulsion.

"The result obtained with 4 pints (which prevented Stomoxys and Tabanidae from biting for three days) was very different from that obtained with 3 pints (which prevented Tabanidae from biting a camel for 1 hour only), but I do not think it is due to the extra pint of oil used. At this time of the year the quantity of hair on camels varies greatly. The camel that was smeared with 3 pints had practically no hair, whereas both camels that were smeared with 4 pints had a fair quantity of hair. The matting of the hair by the oil might explain why the Tabanidae did not attack those parts where there is hair, but it does not explain why the Tabanidae did not attack the camels smeared with 4 pints on the sheath, etc., where there is never any hair on camels. In experiments with repellents for protecting animals from the attacks of Tabanidae and other biting flies the results obtained depend to a great extent on whether the flies are very hungry or not.

"Castor oil is of no practical value on account of the cost. Smearing a camel with 4 pints costs over Rs.2–8–0."

Blackquarter.—In order to determine whether camels are susceptible to this disease three camels were inoculated with blackquarter virus, one young buffalo and one calf acting as controls. The results indicated that camels are as susceptible to blackquarter as bovines, and that the symptoms of blackquarter in camels are identical with those in bovines.

Haemorrhagic Septicaemia.—This disease causes a very large number of deaths in India amongst bovines; in order to determine whether camels are susceptible to this disease, two camels were inoculated with 2 cc. of culture, and two goats and two rabbits acted as controls. The results of these experiments appear to indicate that camels are not susceptible to haemorrhagic septicaemia.

Rinderpest.—Experiments to test the susceptibility of camels to rinderpest gave no result as the blood inoculated proved to be avirulent for control cattle.

Feeding experiments.—The average amounts of green fodder and water that can be ingested daily by a camel at rest when given a certain quantity of concentrated food were determined. It was found that:—

"(1) The average amount of green taramira that a camel will eat, when doing no work and receiving 6 lbs. of gram, is 66 lbs.

"(2) The average daily amount of water that a camel will drink when fed on green fodder and when the temperature is not high and doing no work is 2½ gallons.

"(3) The average daily amount of water drunk by one camel, fed on gram and missa bhoosa, and doing ordinary work, was 5 gallons. When ridden on 2 successive days 14 miles (in the month of March when the temperature was not very high) the amount of water drunk was 9½ and 8 gallons, respectively."

Further experiments in this direction will be undertaken next year.

Sore throat.—Details are given with regard to the history of one case of this disease, which appears to be fairly prevalent in camels. Nothing appears to be known as regards the etiology. It is stated that until the cause of the disease is determined all that can be done is to treat the symptoms.

"A dose of Epsom salts, 1–2 lbs. (according to the size of the animal) should be given at once. Fomentations may be applied to the throat, and green fodder placed in front of the animal. The animal should be placed in the shade and left alone. On no account should the camel be worried by allowing the camelmen to force food down its throat.

"Camelmen fire the throat and maintain that if this is not done the animal in every case dies; but if the throat is fired a number of cases recover."

Jhooling or *Jhoolak.*—"This is a contagious disease of camels manifesting itself in the formation of local tumours—hot and painful, of a fibrous character, and terminating in suppuration and raw patches." It is widely distributed throughout the Punjab and usually occurs in the cold weather; the etiology is unknown. Horses, cattle, buffaloes, dogs, guinea-pigs and rabbits appear to be immune, but the disease is easily transmissible by contact to healthy camels. Examination of the pus of the abscesses reveals the presence of streptococci.

Treatment consists in the excision of the lesion or the application of a blister in order to hasten abscess formation. The lesions heal up, leaving on the skin small white spots which last several months. With regard to preventive treatment it is advised that no camel should be bought if it presents such spots; also when a case occurs strict isolation should be enforced.

Rheumatism.—Camels suffer a great deal from articular rheumatism. No cases of muscular rheumatism were observed. The disease is very prevalent in all parts of the Punjab and appears to be caused by bad hygienic conditions, such as improper feeding, cold and damp, and apparently also by feeding on shisham leaves.

Wail.—This disease is common in one part of the Punjab and is characterised by loss of control of the hind legs with consequent difficulty in sitting down and getting up, thus resembling those of kumree in horses. The etiology is unknown, but the disease is probably due to grazing continuously on lana. Inoculation of blood into camels and other animals gave negative results. No therapeutic treatment proved beneficial.

A small experiment on dachi's milk indicated that " butter can be made from camel's milk," but that " it takes four times as long to get butter from camel's milk as from cow's milk."

Surra.—No attempts were made to treat camels by Commandants of the various Camel Corps except in one instance, where excellent results were obtained by the administration of arsenic alone and a combination of arsenic and soamin. The figures in this instance were as follows:—Total number of camels treated 158, number of camels cured 129, number of camels died under treatment 29, number of relapses nil.

Further experiments were carried out in connection with treatment; the following are briefly the results:—

(1) *Alternate doses of mercury perchloride and chinosol* administered intravenously (4 times altogether) apparently appeared to have effected a cure in the case of five diseased camels after from 13 to 15 days from the commencement of the treatment. Relapses, however, occurred in all cases between the 10th and 28th day after the last dose of chinosol. It is concluded that alternate doses of these drugs given intravenously in as large doses as can be tolerated have no curative action against surra.

(2) *Alternate doses of iodine and soamin* with intervals of one day between each dose did not give satisfactory results.

(3) *Alternate doses of iodine and mercury perchloride* gave very unsatisfactory results.

It is stated that a variety of other drugs were tried, none of which gave satisfactory results.

Experiments were carried out with regard to the course that surra runs in the camel and also in ponies. The camel experiments are apparently not yet completed. It was found that ponies are susceptible to camel surra, but that the course which the disease runs in old and in young ponies is very different. The same difference is noticed when old and young camels are inoculated with surra. In the case of old camels death takes place rapidly whereas in one year old camels the disease does not run a rapid course. Surra may produce cerebral symptoms in ponies and these symptoms are also seen at times in camels suffering from the disease. Pus in the sinuses may be produced. Surra does not always cause emaciation.

In the case of two goats inoculated with camel surra, although no trypanosomes could be observed in the peripheral circulation of either goat, blood was shown to be infective; when 1 cc. of blood was injected (126 days after the goats were inoculated with camel surra) into rabbits and guinea-pigs, these animals developed surra.

Three sheep were inoculated with blood from a camel suffering from surra. In two, trypanosomes appeared in the peripheral circulation after an incubation period of 10 days, and in the third after 11 days. The paroxysm lasted two to four days; the blood of each sheep was daily examined for 115 days but no trypanosomes were again observed.

With the object of ascertaining whether old camels are immune to surra a camel 18 years old was procured that had been on the strength of a certain unit for over 13 years, and thus must have been through several surra outbreaks. When inoculated with infective blood, trypanosomes appeared in the circulation on the seventh day after inoculation and were present except on one day until the animal died 18 days after the inoculation. Three one year old camels, inoculated with surra at the same time as this old animal, developed the disease with frequent paroxysms at the commencement, but gradually these became less frequent and all three improved in condition and at the present time would not be suspected of having surra.

In the course of an investigation as to the cause of an outbreak of surra at Chakdara valuable information was obtained as to whether camels suffering from the disease are dangerous to ponies. Tabanidae were swarming in the camp and a high proportion of the camels were infected. After a few weeks 5 out of 14 ponies kept at the same camp were found to be suffering from surra. It is concluded that the ponies contracted the disease from the camels and that thus ponies should not be kept in contact with camels.

The report concludes with a description of an outbreak of anthrax and of another outbreak of a disease of unknown origin.

Uganda Protectorate. **Annual Report of the Department of Agriculture for the Year ended 31st March 1916.**—62 pp. f'cap. 1916. Entebbe: Government Printer. [Report of the Chief Veterinary Officer [Hutchins (E.).] pp. 40–43.]

Rinderpest.—The work of the year was almost entirely confined to the inoculation of cattle in the Mengo district of the Buganda Province, and in bringing a widespread outbreak in that district under control. The disease appeared in the early months of 1915 on the extreme eastern side of the district near the Nile, but early in May it appeared in the Bukoba division of Kiagwe, an area heavily stocked with cattle, the infection having spread from the neighbouring infected areas in Bugerera. Between May 20th and July 26th, 5,007 cattle were inoculated in the Bukoba division; the deaths amongst the non-inoculated cattle were estimated at 1,800, or about 80 per cent. of the non-inoculated stock.

In July the disease further extended into the neighbouring county of Bulemezi and spread rapidly northwards along the Sezibwa River into Buruli. Inoculation camps were formed at two places, where inoculations were carried on until the end of October, to cope with the rapid spread of the disease in Bulemezi.

In October outbreaks occurred simultaneously in other centres, all these being probably due to the illicit movement of cattle from the infected areas in Southern Bulemezi.

Another inoculation camp was opened near Entebbe in November; owing to the prevalence of trypanosomiasis amongst the cattle in the surrounding districts it was not considered advisable to perform the double inoculation. Cattle here were thus inoculated with a protective dose of serum only; in some instances this gave unsatisfactory results as several herds were inoculated whilst in the incubative period.

Many of the herds from Buruli sent for inoculation were found to be heavily infected with trypanosomiasis. In Buruli the buffalo and the bush pig were reported to have died in considerable numbers.

In these districts the total number of adult cattle inoculated was 13,833; deaths, 1,959; calves inoculated, 3,438; deaths, 1,106.

In the Eastern Province rinderpest has been prevalent since it was introduced from British East Africa in 1910; losses appear to have been mainly confined to the young stock.

The Western Province still remains free from rinderpest.

Trypanosomiasis.—Many of the Buruli herds from near Lake Kioga were found to be heavily infected, heavy losses being caused amongst transport cattle. *Glossina morsitans* continues to spread in an easterly direction in Southern Ankole.

Foot-and-mouth disease.—Has been prevalent in Ankole during the past two years, and, in the great majority of cases, it appears in a very mild form.

Diseases of Equines.—Lymphangitis was, as usual, the most common disease amongst mules.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 4. No. 4, pp. 201–205.]

PROTOZOAN PARASITES.

BOUILLIEZ (Marc). Recherches expérimentales sur *Leishmania tropica.*—*Bull. Soc. Path. Exot.*, 1917. Jan. 10. Vol. No. 1. pp. 66–83.

da CUNHA (A. M.). Contribuição para o conhecimento da fauna de protozoarios do Brazil IV. [The Protozoan Fauna of Brazil IV.]—*Mem. Inst. Oswaldo Cruz.*, 1916. Vol. 8. No. 1. pp. 66–73. With 1 plate.

FANTHAM (H. B.) & PORTER (Annie). The Pathogenicity of *Giardia* (*Lamblia*) *intestinalis* to Men and to Experimental Animals.—*Brit. Med. Jl.*, 1916. July 29. pp. 139–141.

da FONSECA (O. O. R.). Estudos sobre os flajelados parasitos dos mamiferos do Brazil. [The Parasitic Flagellates of Mammals in Brazil.]—*Mem. Inst. Oswaldo Cruz.*, 1916. Vol. 8. No. 1. pp. 5–39. With 2 plates comprising 26 figs. and 4 text-figs.

HECKENROTH (F.). Deux nouveaux cas de leishmaniose canine à Dakar. [Two New Cases of Canine Leishmaniosis at Dakar.]—*Bull. Soc. Path. Exot.*, 1916. Nov. Vol. 9. No. 9. pp. 696–697.

KOFOID (C. A.) & CHRISTIANSEN (Eliz. B.). On *Giardia Microti*, sp. nov., from the Meadow Mouse.—*Univ. California Publicat. in Zool.*, 1915. Nov. 19. Vol. 16. No. 2. pp. 23–29. With 1 text-fig.

——. On Binary and Multiple Fission in *Giardia muris* (Grassi).—*Ibid.* pp. 30–54. With 3 plates and 1 text-fig.

—— & McCULLOCH (Irene). On *Trypanosoma triatomae*, a New Flagellate from a Hemipteran Bug from the Nests of the Wood Rat, *Neotoma fuscipes.*—*Univ. California Publicat. Zool.*, 1916. Feb. 18. Vol. 16. No. 10. pp. 113–126. With 2 plates.

KOLMER (J. A.), SCHAMBERG (J. F.) & RAIZISS (G. D.). Various Methods for determining the Trypanocidal Activity of Substances in vitro and their Relation to the Chemotherapy of Experimental Trypanosomiasis.—*Jl. Infect. Dis.*, 1917. Jan. Vol. 20. No. 1. pp. 10–27.

——, —— & ——. The Numeric Relationship of Infection to the Chemotherapy of Experimental Trypanosomiasis.—*Ibid.* pp. 35–44.

KUDO (Rokusaburo). Contributions to the Study of Parasitic Protozoa. III. Notes on Myxosporidia found in some Fresh-Water Fishes of Japan, with the Description of Three New Species.—*Jl. Parasit.*, 1916. Sept. Vol. 3. No. 1. pp. 1–9. With 4 text-figs.

LÉGER (M.). Observations sur quelques Leucocytozoon d'oiseaux de la région de Reims. [Some Leucocytozoon of Birds in the Neighbourhood of Reims.]—*Bull. Soc. Path. Exot.*, 1917. Jan. Vol. 10. No. 1. pp. 28–33.

—— (L.) & HESSE (E.). Sur la structure de la spore des Microsporidies. [Spore Structure of Microsporidia.]—*C.R. Soc. Biol.*, 1916. Dec. 2. Vol. 79. No. 19. pp. 1049–1053.

MACFIE (J. W. Scott). The Morphology of Certain Spirochaetes of Man and Other Animals.—*Ann. Trop. Med. & Parasit.*, 1916. Dec. 16. Vol. 10. No. 3. pp. 305–343. With 6 text-figs.

——. A Flagellate frequenting the Necks of Bottles.—*Jl. Trop. Med. & Hyg.* 1917. Jan. 1. Vol. 20. No. 1. pp. 1–3. With 12 text-figs.

——. Preliminary Note on a Monomorphic Trypanosome found in the Blood of a Native of the Gold Coast.—*Brit. Med. Jl.*, 1916. Jan. 6. pp. 12–13. With 1 chart.

MAYER (Martin). Zur Symbiose von Spirochäten und fusiformen Bazillen bei geschwürigen Prozessen. [Symbiosis of Spirochaetes and Spindle-shaped Bacilli in Suppurative Processes.]—*Arch. f. Schiffs- u. Trop. Hyg.*, 1916. Oct. 1. Vol. 20. No. 19. pp. 442–444.

MEDICAL JOURNAL OF AUSTRALIA. Piroplasmosis in New South Wales. Extracted in *Vet. Record,* 1916. Sept. 2. No. 1469. pp. 100–101.

de MELLO (F.). Quelques considérations sur les affinités zoologiques du genre "Haemocystidium," avec description d'une espèce nouvelle. —*Anais Scientif. da Faculdade de Med. do Pôrto.*, 1916. Vol. 3. No. 1. 11 pp. With 1 coloured plate.

NOVAES (E.). La trypanosomiase brésilienne et son rapport avec le corps thyroide. Travail fait à l' Institut pathologique de l'Université de Genève.—*Rev. Méd. de la Suisse Romande,* 1916. Sept. 20. Vol. 36. No. 7. pp. 592–614. With 2 plates.

OHIRA (Tokuzo) & NOGUCHI (Hideyo). The Cultivation of Trichomonas of the Human Mouth (*Tetratrichomonas hominis*).—*Jl. Experim. Med.*, 1917. Feb. 1. Vol. 25. No. 2. pp. 341–347. With 4 plates comprising 18 figs. (9 coloured).

PLATAU (Lilli). Untersuchungen über die trypanozide Substanz des menschlichen Serums bei Gesunden und Leberkranken. [The Trypanocide Substance of Human Serum in Health and in Liver Affections.]—*Zeitsch. f. Hyg. u. Infektionskr.*, 1916. Vol. 81. pp. 401–429.

PRINGAULT (E.). La leishmaniose canine à Marseille. [Canine Leishmaniasis at Marseilles.]—*Bull. Soc. Path. Exot.*, 1916. Nov. Vol. 9. No. 9. pp. 697–698.

METAZOAN PARASITES.

Arthropods (Acari, Flies, Ticks).

BARBER (L. B.). Report of the Animal Husbandman and Veterinarian. —*Rep. Guam Agric. Expt. Sta.*, 1915. 1916. pp. 23–41. With 4 figs. and 3 plates.

BEACH (W. H.). The Sheep Maggot-Fly and How to Control it.—16 pp. With 5 figs.—Bridgnorth : Published by the Beach Chemical Co.

BOUET (G.) & ROUBAUD (E.). Répartition des glossines à la Côte d'Ivoire. [Distribution of Tsetse flies in the Ivory Coast.]—*Bull. Soc. Path Exot.*, 1917. Jan. Vol. 10. No. 1. pp. 37–39.

COOK (F. C.) & HUTCHISON (R. H.). Experiments during 1915 in the Destruction of Fly Larvae on Horse Manure.—*U.S. Dept. Agric.*, Bull. No. 408. 1916. Oct. 28. 20 pp.

CORSON (J. F.). Entomological and Other Specimens collected in the Northern Territories, chiefly in the Districts of Wa and Lorha. —*Rept. Accra Laboratory for the Year* 1915. pp. 30–35. London: J. & A. Churchill.

COUSINS (H. H.). General Observations.—*Ann. Rep. Jamaica Dept. Agric. for the Year ended* 31*st March*, 1916. 1916. pp. 1–4.

CURLEWIS (A. W.). Sheep Dips.—*Jl. Dept. Agric. Victoria*, 1916. July. Vol. 14. No. 7. pp. 423–432. With 8 figs.

DESCAZEAUX (J.). Traitement de la gale. [Treatment of Mange.]— *Rec. Méd. Vét.*, 1916. July 30. Vol. 92. No. 14. pp. 227–237. With 1 fig.

FERGUSON (E. W.). Notes on Tabanidae.—*Rep. Director-General of Public Health, New South Wales, for the Year ended* 31*st December*, 1914. 1916. pp. 205–206.

FROGGATT (W. W.). A New Parasite on Sheep-Maggot Flies. Notes and Description of a Chalcid Parasite (*Chalcis calliphorae*).—*Queensland Agric. Jl.*, Brisbane, 1916. Sept. 3. Vol. 6. No. 3. pp. 177–179. With 1 plate. *Agric. Gaz. N.S.W.* 1916. July. Vol. 27. No. 7. pp. 505–507. With 1 plate.

—— (W. W. & T. L.). Sheep-Maggot Flies, No. 2.—*Dept. Agric. New South Wales, Sydney, Farmers' Bulletin.* No. 110. 1916. Aug. 30 pp. With 8 figs.

GARDEN (G.). Report by the Senior Veterinary Officer.—*Ann. Rep. Dept. Agric. Nyasaland for the Year ended* 31*st March*, 1916. June 30. pp. 17–18.

HARRISON (Launcelot). The Genera and Species of Mallophaga.—*Parasitology*, 1916. Oct. Vol. 9. No. 1. pp. 1–156.

ILLINGWORTH (J. F.). Notes on the Hen Flea (*Echidnophaga gallinacea*, Westw.)—*Proc. Hawaiian Entom. Soc.*, Honolulu, 1916. Sept. Vol. 3. No. 3. pp. 252–254.

IMES (M.). Sheep Scab.—*U.S. Dept. Agric. Farmers' Bull.*, 1916. Apr. 17. No. 713. pp. 36. With 21 figs.

KOCH (H.). Bericht über einen Versuch, *Glossina palpalis* durch Fang zu beseitigen. [An Experiment on the Eradication of *Glossina palpalis* by means of Fly-Traps.]—*Arch. f. Schiffs- u. Trop.-Hyg.*, 1914. Dec. Vol. 18. No. 24. pp. 807–813.

LAHILLE (F.). Notas sobre los Argásidos chilenos. [Notes on Chilian Argasidae.]—*Anales Zool. Aplicada*, 1915. Apr. 30. Vol. 2. No. 1. pp. 5–11. With 1 plate.

LOCKHEAD (W.). Some Notes regarding Bose and other Bot Flies.— *46th Ann. Rep. Entom. Soc. Ontario*, 1915. 1916. pp. 102–108. With 5 figs.

LUTZ (A.), NEIVA (A.) & COSTA LIMA (A.). Sobre "Pupipara" ou "Hippoboscidae" de aves brasileiras. [Pupipara or Hippoboscids of Brazilian Birds.]—*Mem. Inst. Oswaldo Cruz*, 1915. Vol. 7. No. 2. pp. 173–199. With 2 plates.

MACFIE (J. W. Scott). Chlorine as a Larvicide.—*Rep. Accra Laboratory for the Year* 1915. p. 71.

——. Notes on the Insects collected at Accra during the Year.—*Ibid.* pp. 76–79. With 1 plate.

MASON (C.). Report of the Government Entomologist.—*Ann. Rep. Dept. Agric. Nyasaland for the Year ended 31st March,* 1916. 1916. June 30. pp. 19–22.

MAYR (L.). Die Bekampfung der Pferdelaus mit Ikaphthisol. [Control of the Horse Louse with Ikaphthisol.]—*Berlin. Tierarzt. Woch.* 1916. June 15. Vol. 32. No. 24. pp. 279–281.

NEUMANN (L. G.). Ixodides (Acariens); première série, [Ixodidae (Acarina); First Series.] (*Ixodes, Eschatocephalus, vespertilionis,* Koch, and *Ixodes hexagonus,* Leach).—*Arch. Zool. Expt.,* Paris, 1916. Oct. Vol. 55. No. 12. pp. 515–527. With 1 plate.

NOBBS (E. A.) & SINCLAIR (J. M.). Compulsory Dipping.—*Rhodesia Agric. Jl.,* 1916. Aug. Vol. 13. No. 4. pp. 466–473.

RÈNE (C.). Pour protéger les animaux contre les atteintes des mouches. [The Protection of Animals against Flies.]—*Progrès Agricole,* 1916. July 9. Vol. 30. No. 1486. pp. 366–367.

RODHAIN (J.) & BEQUAERT (J.). Matériaux pour une Etude monographique des Diptères Parasites de l'Afrique. i. [Materials for a Monograph on the Parasitic Diptera of Africa.]—*Bull. Sci. France et Belgique,* 1916. Apr. 29. Ser. 7. Vol. 49. No. 3. pp. 236–289. With 14 figs.

SCHMIDT (M.). Durch die Kolumbácser Mücken hervorgerufene Erkrankungen. [Sickness among Live-Stock caused by "Kolumbácser Gnats."]—*Deut. Tierarzt. Woch,* 1916. July 1. Vol. 24. No. 27. pp. 247–248.

SHIRCORE (J. O.). A Method for the Trapping of *Glossina morsitans* suggested for Trial.—*Trans. Soc. Trop. Med. & Hyg.,* 1916. Jan. Vol. 9. No. 3. pp. 101–102. With 3 diagrams.

SWENK (M. H.). Descriptions and Records of North American Hippoboscidae.—*Jl. New York Entom. Soc.,* 1916. June. Vol. 24. No. 2. pp. 126–136.

TAYLOR (F. H.). Report on Work done during the Second Half of 1915. —*Half-Yearly Rep. Australian Inst. Trop. Med., Townsville, Queensland, from 1st July to 31st December,* 1915. 1916. pp. 8–10.

TRYON (H.). The Spider or Tick Fly of the Horse (*Hippobosca equina,* Linné).—*Queensland Agric. Jl.,* Brisbane, 1916. Oct. Vol. 6. No. 4. pp. 267–274.

Helminths.

BOYNTON (W. H.) & WHARTON (L. D.). Notes on a Fatal Parasitic Infestation in a Herd of Cattle and Goats in the Province of Ambos Camarines (Philippine Islands).—*Philippine Agric. Rev.,* 1916. 4th Quarter. Vol. 9. No. 4. pp. 348–353. With 2 plates.

HALL (M. C.). *Hasstilesia tricolor* (Stiles and Hassall, 1894), a Common Parasite of Rabbits in the United States. *Jl. Amer. Vet. Med. Assoc.,* 1916. Jan.

MACFIE (J. W. Scott). A Note on the Provisionial Identifications of Worms collected at Accra.—*Rep. Accra Laboratory for the Year* 1915. pp. 80–81.

RANSOM (B. H.). The Occurrence in the United States of Certain Nematodes of Ruminants Transmissible to Man.—*New Orleans Med. & Surg. Jl.,* 1916. Oct. Vol. 69. No. 4. pp. 294–298.

SEURAT (L. G.). Dispharages d'Algérie. [Dispharagia of Algeria.]—*C.R. Soc. Biol.*, 1916. Nov. 4. Vol. 79. No. 17. pp. 934–938. With 4 text-figs.

——. Sur les Dispharages des Rapaces. [Dispharagia of Birds of Prey.] *C.R. Soc. Biol.*, 1916. Dec. 16. Vol. 79. No. 20. pp. 1126–1130. With 2 text-figs.

——. Sur deux Filaires des Reptiles du Nord-Africain. [Two Filaria of North African Reptiles.]—*C.R. Soc. Biol.*, 1916. Dec. 16. Vol. 79. No. 20. pp. 1131–1136. With 3 text-figs.

SKRYABIN (K. J.). *Seuratia* n.g. nouveau genre de Nématodes d'oiseaux. [Seuratia, n.g. a New Genus of Nematodes of Birds.]—*C.R. Soc. Biol.*, 1916. Nov. 18. Vol. 79. No. 18. pp. 971–973.

STUNKARD (H. W.). On the Anatomy and Relationships of Some North American Trematodes.—*Jl. Parasit.*, 1916. Sept. Vol. 3. No. 1. pp. 21–27.

WALTON (A. C.). A case of the Occurrence of *Ascaris triquetra* (Schrank) in Dogs.—*Jl. Parasit.*, 1916. Sept. Vol. 3. No. 1. pp. 39–41. With 6 text figs.

WARD (H. B.). Notes on two Free-living Larval Trematodes from North America.—*Jl. Parasit.*, 1916. Sept. Vol. 3. No. 1. pp. 10–20. With 1 plate.

MYCOTIC DISEASES.

BEAUVERIE (J.). Quelques proprietés des ascospores de levures. Technique pour leur différenciation. [Some Properties of the Ascospores of Yeasts. Technic for Differentiation.]—*C. R. Soc. Biol.*, 1917. Jan. 6. Vol. 80. No. 1. pp. 5–7.

FAYET & BONNEL. Le traitement de la lymphangite épizootique. [Treatment of Epizootic Lymphangitis.]—*Bull. Soc. Path. Comp.*, 1916. June 13. (Extracted in *Rec. Méd. Vét.*, 1916. Oct. 15. Vol. 42. No. 19. p. 578).

["Potassium iodide, which acts so remarkably in human sporotrichosis, can be employed with good results, concurrently with the local administration of tincture of iodine."]

OMLIN (A.). Uber Hyphomykome beim Pferde. [Hyphomycoma of the Horse.]—*Schweiz. Arch. f. Tierheilk*, 1916. Dec. Vol. 58. No. 12. pp. 655–707. With 4 plates.

TUNNICLIFF (Ruth). Streptothrix in Bronchopneumonia of Rats similar to that in Rat-Bite Fever.—*Jl. Infect. Dis.*, 1916. Dec. Vol. 19. No. 6. pp. 767–772. With 3 plates comprising 7 figs.

DISEASES DUE TO ULTRA-VISIBLE VIRUSES.

CAMUS (L.). Dispositif pour la préparation du vaccin sec. Cloche à joints de mercure, pour la dessication dans le vide. [Apparatus for Preparation of Dried Vaccine. Bell-jar with Mercury Connection Joints for Desiccation in vacuo.]—*C.R. Soc. Biol.*, 1916. Nov. 18. Vol. 79. No. 18. pp. 1010–1011. With 1 text-fig.

——. Nécessaire pour le controle physiologique de l'activité du vaccin. [Apparatus for Physiological Control of the Activity of Vaccine.]—*C.R. Soc. Biol.*, 1916. Dec. 16. Vol. 79. No. 20. pp. 1105–1108.

GINS (H. A.). Uber experimentelle Vaccine und Vaccineimmunität. Bericht über die im Auftrage des Herrn Ministers des Innern unternommenen Versuche. [Experimental Vaccinia and Vaccinia Immunity.]—*Zeitsch. f. Hyg. u. Infektionskr.*, 1916. Aug. 18. Vol. 82. No. 1. pp. 89–141.

—— & WEBER (R.). Uber den Nachweis der in die Blutbahn eingespritzten Vaccinevirus in inneren Organen bei Kaninchen. [Effects of Intravenous Inoculation of Vaccine Virus on the Internal Organs of Rabbits.]—*Zeitsch. f. Hyg. u. Infektionskr*, 1916. Aug. 18. Vol. 82. No. 1. pp. 143–154.

HETSCH (H.). Ueber Tollwut. [On Rabies.]—*Deutsche Med. Woch.*, 1916. July 6. Vol. 42. No. 27. pp. 807–811.

LEBRUN (Octave). Sur la rage (A propos de l'arrêté de police permanent du 20 juillet 1916, sur la circulation des chiens). [A propos of a Decree concerning Recent Increase in Rabies in France.]—*Rec. Méd. Vét.*, 1916. Oct. 30. Vol. 92. No. 20. pp. 311–314.

LECLAINCHE. Sur la rage (à propos de la communication de M. Lebrun).—*Rec. Méd. Vét.*, 1916. Nov. 30. Vol. 92. No. 22. pp. 329–333.

MOUSSU. Sur la rage (à propos de l'arrêté du 20 juillet 1916, par M. Rouayx, — de Gaillac).—*Rec. Méd. Vét.*, 1916. Nov. 30. Vol. 92. No. 22. pp. 328.

POULTON (W. F.). A Treatment for Horse Sickness.—*Vet. Record.*, 1916. Sept. 2. Vol. 29. No. 1,469. pp. 95–96.

[Quinine apparently gave very successful results in the treatment of a disease which, however, the author admits, could not be definitely diagnosed as horse-sickness.]

ROBBINS (W. S.). Further Studies on the Virulent Salt Solution used in the Production of Hog-Cholera Serum.—*Jl. Infect. Dis.*, 1916. Nov. Vol. 19. No. 5. pp. 708–711.

WEHRBEIN (H.). Agglutinins in Hog-cholera Immune Serum for *Bacillus suipestifer.*—*Jl. Infect. Dis.*, 1916. Sept. Vol. 19. No. 3. pp. 446–451.

BACTERIAL DISEASES.

HERSHBERGER (F. C.). Anthrax in Manchuria.—*Amer. Jl. Vet. Med.*, 1917. Jan. Vol. 12. No. 1. pp. 11–12 and 18.

[A subcutaneous form of anthrax, transmitted by the bites of Tabanidae, accounted each year for the loss of between 70 and 80 per cent. of all live stock and of about 20 per cent. of the labourers in the district. The disease was successfully dealt with by the administration of anti-anthrax serum and anthrax spore-vaccine.]

FRANKLIN (O. M.) & HASLAM (T. P.). The Strength and Composition of Black Leg Vaccines.—*Jl. Infect. Dis.*, 1916. Sept. Vol. 19. No. 3. pp. 408–415.

MISCELLANEOUS.

AUBRY. Premiers essais d'élevage méthodique à l'autrucherie de Meknès (Maroc). [First Attempts at Methodical Rearing in the Ostrich Farm at Meknès (Morocco).]—*Rec. Méd. Vét.*, 1916. Nov. 15. Vol. 92. No. 21. pp. 622–634. With 9 text-figs.

BENIANS (T. H. C.). Relief Staining for Bacteria and Spirochaetes.—*Brit. Med. Jl.*, 1916. Nov. 25. p. 722.

BLANCHARD (Raphaël) Méconnaissance de la nomenclature zoologique et botanique et de l'histoire des sciences biologiques ; son influence fâcheuse sur le langage médical.—*Bull. Acad. Méd.*, 1916. Nov. 21. Extracted in *Rev. Gén. Méd. Vét.*, 1917. Jan. 15. Vol. 26. No. 301. pp. 37–38.

CONOR (Marthe). Les Invasions de Sauterelles en Afrique Mineure (Figurations et Textes anciens). [Locust Invasions in Lesser Africa (Early Figures and Texts).]—*Arch. Inst. Pasteur Tunis.*, 1916. Apr. 1. Vol. 9. No. 3. pp. 149–156. With 1 plate.

CROWTHER (C.). Palm Kernel Cake as Meal and Food for Pigs.—*Jl. Board Agric.*, 1916. Dec. Vol. 23. No. 9. pp. 850–859.

FARMER (J.). Report of the Punjab Civil Veterinary Department for the year 1915–16 (abridged).—*Vet. Record*, 1917. Jan. 6. No. 1487. pp. 281–284.

GAUDUCHEAU (A.). Mélange colorant pour remplacer le Giemsa.—*Bull. Soc. Med. Chirurg. Indochine*, 1916. Sept. 10. Vol. 7. No. 8. 5 pp.

GIBSON (R. B.) & CONCEPCIÓN (Isabelo). The Influence of Fresh and Autoclaved Cow's Milk on the Development of Neuritis in Animals. —*Philippine Jl. Sc.*, 1916. May. Vol. 9. See B. No. 3. pp. 119–134. With 2 plates comprising 6 figs.

GRAHAM (R.) & HIMMELBERGER (L. R.). Studies on Forage Poisoning.—*Jl. Infect. Dis.*, 1916. Sept. Vol. 19. No. 3. pp. 385–394. With 3 figs.

LARCHER (O.). Les blessures et les maladies des tortues terrestres et aquatiques. [Wounds and Diseases of Terrestial and Aquatic Turtles.]—*Rec. Méd. Vét.*, 1916. Nov. 30. Vol. 92. No. 22. pp. 351–358.

MARSH (C. D.), CLAWSON (A. B.), & MARSH (H.). Larkspur Poisoning in Live Stock.—*United States Dept. of Agric. Bull.*, No. 365. Professional Paper. 1916. Sept. 8. 90 pp.

MOUQUET. Sur le mouton de karakul ou mouton de fourrure dite d'astrakan.—*Rec. Méd. Vét.*, 1916. Dec. Vol. 92. No. 24. pp. 376–381. Sur les chevaux de Turkmens. Hygiène. Entrainement. Cheval yorgha de trait et de boucherie.—*Ibid.* pp. 381–385.

SCHLEMMER. Untersuchungen über den Mecanismus der Amboceptor— und Komplementwirkung. [Researches on the Mechanism of the Action of Amboceptor and Complement.]—*Arbeit. a. d. Kaiserl. Gesundheitsamte*, 1916. March. Vol. 50. No. 3. pp. 341–360.

TIFFANY (L. C.). Diagnosis and Pathology of Periodic Opthalmia of Horses.—*Amer. Jl. Vet. Med.*, 1916. Dec. Vol. 11. No. 12. pp. 951–952 and 987–988.

TRIBONDEAU (L.). Sur le mode d'emploi du bi-éosinate. [Method of Using Bi-eosinate (Stain).]—*C.R. Soc. Biol.*, 1916. Dec. 2. Vol. 79. No. 19. pp. 1022–1024.

——. Etalement du sang sur lames de verre porte-objets par le "procédé des ciseaux." [Spreading a Blood-Film on a Glass Slide by Means of the "Scissors Method."]—*C.R. Soc. Biol.*, 1916. Nov. 18. Vol. 79. No. 18. pp. 1011–1012.

[There is nothing new in this method. It simply consists in using the blade of a pair of scissors or of an old knife for drawing out a drop of blood along a slide by means of capillary attraction.—ED.]

VETERINARY RECORD. 1916. Dec. 30. No. 1486. pp. 273–274.—Veterinary Education in Russia.

VETERINARY RECORD. 1917. Jan. 27. No. 1490. pp. 311–313 p. 320. Veterinary Services. German South West African Campaign and Rebellion. August 1914 to July 1915, and Subsequent Period—July 1915 to 1st March 1916. [Report by Colonel Jas. Irvine Smith, J.P., Director of Veterinary Services, Union Defence Forces. (Abridged Report).]

WEBSTER (P. J.). Notes on Cinchona in Java.—*Philippine Agric. Rev.*, 1916. 4th Quarter. Vol. 9. No. 4. pp. 273–277.

WEHRLE. Das Veterinärwesen einschliesslich einiger Gebiete in Argentinien (Nach Berichten des Kaiserlichen Generalkonsulats in Buenos Aires und anderen Quellen). [The Veterinary Profession including some of its Functions in the Argentine Republic. (According to reports from the Imperial Consul-General at Buenos Aires and other Sources.)]—*Arbeit. a. d. Kaiserl. Gesundheitsamte*, 1915. Dec. Vol. 50. No. 2. pp. 164–203.

For CONTENTS, see pages 3 & 4 of Cover

pp. 85-140.] [June, 1917.

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TROPICAL VETERINARY BULLETIN.

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DISEASES DUE TO PROTOZOAN PARASITES.

(a) "Black-head" in Turkeys [Amoebiasis (?)]

Smith (Theobald) & Smillie (Ernest W.). **Note on Coccidia in Sparrows and their Assumed Relation to Blackhead in Turkeys.**—*Jl. Experim. Med.* 1917. Mar. 1. Vol. 25. No. 3. pp. 415–420. With 1 table.

The authors were induced to study coccidiosis in sparrows on account of the constant appearance of these birds in the unprotected yards of incubator-hatched turkeys and on account of the view of Hadley (1910) that the causal parasite of "blackhead" described by the first-named author in 1894 as *Amoeba meleagridis* is merely a stage in the development of the avian coccidium *Eimeria avium*, and is disseminated and transmitted by various species of birds. No experimental proof has, however, been furnished to support the latter view.

In all 54 sparrows were trapped or shot in the experimental turkey yard at Princeton, N.J.; no visible signs of disease were discoverable in any. Search was made in scrapings from the duodenal mucous membrane for the sexual stages and for sporulating forms in the rectal contents by sowing on a medium consisting of 2 per cent. agar in 0·5 per cent. watery salt solution. Sections were also cut from the duodenum for histological study. The results showed that 43 of the birds, or 80 per cent., were infected with coccidia. The sparrows were all adults.

The parasites in the duodenum were all in the sexual stage, macrogametes and macrogametocytes being the only forms present; they were situated in the nuclear zone of the epithelial cells. The total absence of the vegetative or multiplicative cycle suggests that either the sexual phase is suppressed or else it takes place possibly while the birds are still in the nest.

Cultures of faeces uniformly demonstrated a two-spored oocyst and not the four-spored species described by Hadley. Each sporocyst contained four sporozoites. According to Hadley the average measurements of the mature cysts in the turkey were 14 by 21 microns and in the sparrow 22·7 by 21·3 microns, thus indicating that the infesting species are different. The authors' own measurements of the coccidia agreed with those given by Hadley.

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The authors conclude that the two-spored coccidia found by them belonged to the genus *Diplospora* (LABBÉ, 1893) or *Isospora* (SJÖBRING, 1897), and not to *Eimeria*.

In a footnote the authors refer to a paper recently published by HADLEY ascribing the so-called " blackhead " of turkeys to invasions of Trichomonas [see below].

SMITH (Theobald). **Some Field Experiments bearing on the Transmission of Blackhead in Turkeys.**—*Jl. Experim. Med.* 1917. Mar. 1. Vol. 25. No. 3. pp. 405–414.

In the experiments described in this paper the author first shows that it is quite possible to breed healthy young turkeys from the eggs of infected adults. Details are given with regard to the precautions taken in incubating the eggs artificially.

It has been often suggested that the parasite of the disease may be carried or disseminated by poultry, but no conclusive experiments have hitherto been made in connection with this point. The author thus exposed two lots of incubator-hatched young turkeys to contact with domestic fowls—one lot to two fowls from a farm where no turkeys were reared and the other lot to two fowls from a farm where blackhead had caused extensive ravages. The results in both cases were negative.

Both lots of young turkeys were subsequently kept in contact with an infected adult turkey on non-infected ground. This exposure led to disease within 17 days. Out of 9 young turkeys 3 died, 2 recovered, while 4 did not show any symptoms.

Exposure to infected adults on infected ground similarly produced the disease in two lots of young clean turkeys. These were exposed on two farms where the disease existed.

Four of the incubator-hatched young turkeys were placed in contact with infected young turkeys. The exposed birds remained healthy although two of the turkeys they were exposed to died of the disease. From previous experiments the author also concludes that infection is either not transmitted at all or only under exceptional conditions by turkeys in the early acute stage of the disease. It is probably carried and shed by those birds which have successfully passed through an attack.

It is then stated that the mode of transmission of the infection is not known; it appears probable that it is introduced with the food and lodges first in one or both caeca and that faecal matter is the vehicle of infection. The lesions in the intestinal tract are often confined to one caecum only, thus making it improbable that the parasite multiplies higher up. Histological sections of the small intestine moreover failed to reveal any preliminary stage of *Amoeba meleagridis* although in some sections a few rare coccidia were found. It appears that adult turkeys are somewhat more resistant to the disease than the young birds. The lesions in the liver and caeca are associated rather early with an extensive infiltration of round cells while the tendency to necrosis is relatively slight.

HADLEY (Philip B.). **The Part Played by the Goblet Cells in Protozoan Infections of the Intestinal Tract.**—*Jl. Med. Res.* 1917. Mar. Vol. 36. No. 1. pp. 79–86. With 1 plate comprising 11 figs.

In this paper the author indicates the manner in which the flagellate protozoon Trichomonas penetrates the intestinal epithelium in the so-called " blackhead " of turkeys. Organisms of this kind are almost invariably present in the intestinal tract of all animals, but in this disease they appear to undergo a most remarkable development in the deeper mucosa, submucosa, and even in the muscular tissues of the intestinal wall.

The mode of entrance of the parasites was studied by examining the caecum histologically in the early stages of the disease. It was found that the first indication of infection consisted of a bulging out of the lumen of the crypts of Lieberkuhn with a tremendous number of flagellate trophozoites. These had been liberated from the spore mother cells which were abundantly present in the fluid caecal contents and had migrated up the crypts. " They possess the usual Trichomonas features—three anterior flagella and one posterior, a vibratory membrane, nucleus, blepharoplast, rhizoplast, chromatic line, chromatic blocks, axostyle, and nucleus. They are actively motile and measure from 8 to 10μ in length. Their shape is at first crescentic and later oval."

A few of the goblet cells lining the gorged crypts are then seen to contain from one to three or more flagellates. In these cases there is usually a broad opening from the goblet cell into the lumen of the crypt. In many cases there is in addition an opening through the basement end of the cell into a space between the epithelium and its basement membrane and this space may be seen to contain varying numbers of flagellate trophozoites. It is stated that all stages in the passage of the parasite can be seen if one observes a sufficient number of crypts.

The author believes that the parasites effect their passage by means of their " inherent invasive powers " and not on account of the internal pressure within the distended crypts ; a goblet cell may be seen to contain only a few parasites although there is considerable distension within the crypt. The invasion of the cells takes place almost entirely in the region of the fundus.

The parasites next accumulate beneath the epithelial cells detaching them from the basement membrane until the greater number of the parasites that were formerly within the crypt become situated beneath the epithelium. This penetration sometimes results in the disorganisation and disintegration of the epithelial cells, but often the pressure now caused by the parasites causes the epithelium of the fundus to be gradually forced out of the crypt space towards the lumen of the caecum.

The parasites meanwhile penetrate the basement membrane and then the remainder of the mucosa is equally overrun until the muscularis mucosae is reached. This retards their progress for a very short time and then they are found developing in the submucosa. At the same time they spread down through the reticular tissue of the cores of the villi until they have reached the tips where they cause the epithelium to separate from the basement membrane and fall into the lumen of the caecum. Finally, no trace of epithelium can be observed in this area.

The author's observations thus point out that these organisms do not by their own movements effect an entrance between the epithelial cells and that a passage is not necessarily prepared for them by other intestinal organisms such as coccidia or worms. Small numbers of amoebae, together with the flagellates, were sometimes seen by the author in the depth of the crypts, but they were not seen either in the goblet cells or in the deeper tissues; he believes that they are thus of only very slight significance in the pathology of intestinal infections in poultry. "*Amoeba meleagridis* of Theobald Smith is not an exception to that statement, since this organism is not really an amoeba but really the late trophozoite stage of the parasitic flagellate forming the subject of this paper."

HIGGINS (C. H.). i. **Entero-Hepatitis or Black-Head in Turkeys.**—*Dominion of Canada. Dept. of Agric. Health of Animals Branch.* 1915. Feb. 13. *Bulletin No. 17.* With 4 plates. Ottawa: Govt. Printing Bureau. 1915.

— ii. **Entero-Hepatitis or Black-Head and the Biological Laboratory System of Raising Turkeys.**—*Ibid. Bulletin no. 19.* 1916. Jan. 18.

In these papers the author first notes the ravages caused in recent years throughout Canada, the United States, and elsewhere by the above disease, which was first investigated by Theobald SMITH in 1895 and attributed to a parasite called by him *Amoeba meleagridis.* This parasite invades the liver and the two caeca and causes lesions in them, hence the name entero-hepatitis. The losses from the disease are enormous and on some farms amount to 90 per cent. of the young birds. "There is little doubt but that the major portion of the fatalities after the first two weeks result from infection from the parasites of entero-hepatitis or blackhead."

The symptoms of the disease are not particularly characteristic but the affected birds show signs of dulness and exhaustion, and the faeces are more fluid than normal and show yellow streaks and gas bubbles; the head is usually darker than normal. The affected birds usually die in a few days if not treated and on post-mortem examination the liver is found to show yellowish-white circular spots on its surface and usually one or both caeca contain yellowish patches about the size of a walnut; sometimes the whole intestinal tract is inflamed. The author then gives rules with regard to prevention and treatment. Hydrochloric acid has apparently given good results in the treatment of the disease in a few cases.

Infection may be transmitted through adult recovered turkeys, which become chronic carriers of the parasites, and through other poultry such as chickens, which harbour the parasite without being seriously affected by it; ground previously occupied by affected flocks, boots and clothing of attendants, and birds, insects, etc., may carry on the infection. There is a good deal of evidence to show that infection is not transmitted through the egg.

For the prevention of the disease by the so-called "biological laboratory method" of artificial incubation and isolation the following plan was adopted. The section of the farm utilised was divided up into plots each about 1 acre in surface extent and surrounded by a suitable wire fence. Between the plots a vacant strip from 3 to 5 ft. wide was left and the gateways so arranged that entrance could not be effected direct from one plot to another. The ground containing the turkey plots was surrounded by a boundary fence at a distance of about 10 ft. from the outer plot. Each plot contained a colony house 10 by 12 ft., one side of which is left open. A flock of 25 turkeys could be raised in one plot.

The poults are obtained from eggs by artificial incubation and transferred to the warm chamber or so-called " hover " in the colony house. The author then details at length the care required by these poults. No food is given for the first three days as there is abundant nourishment still in the yolk sac. They are then given a soft mash diet about five times a day and a little water or sour milk and fine grit. In about two weeks time they may be allowed out of the colony house into a run which is covered over so as to protect them against hawks and crows. After a few weeks they are fed three times a day on mixed grain and allowed to roam at will in their plot. Mixed grain together with grit is meanwhile left for them in the colony house and the bedding changed from sand to chaff or straw. Moisture is fatal to young turkeys and every care should be exercised to prevent them getting wet with rain or even dew.

Should one individual poult be found to have a diarrhoea containing yellow particles or froth it must be immediately isolated and the whole of the colony house cleansed and disinfected. The shelters should be thoroughly disinfected at the beginning of each season.

The author considers that the results obtained by this method, as given in the second paper, were quite satisfactory.

(b) Leishmaniasis.

Bouilliez (Marc). **Recherches expérimentales sur *Leishmania tropica*.** [Investigations on *Leishmania tropica*.]—*Bull. Soc. Path. Exot.* 1917. Jan. Vol. 10. No. 1. pp. 66–86. With 1 text fig. & 2 tables.

The virus used in these experiments was obtained from two natives affected with oriental sore examined at Fort Archambault. A description is given of the parasite and of pathogenicity tests on various experimental animals by means of intradermic and intraperitoneal inoculation. The author's conclusions are as follows:—

" The African monkeys belonging to the family Cercopithecus (*Cynocephalus*, *Cercopithecus patas*, *Cercopithecus callitrichus*) are susceptible to *Leishmania tropica*, and in them a cutaneous lesion resembling the human oriental boil is produced at the point of inoculation.

" They do not react to intraperitoneal inoculation.

" The same results are produced in the case of the dog.

" Small rodents belonging to the rat genus, or some nearly related genus, become affected with a generalised infection following intraperitoneal inoculation and this is manifested by the presence of *Leishmania tropica* in the blood-forming organs and certain viscera; this is accompanied generally, after a certain interval, by the appearance of local lesions, during the development of which the infection may disappear from the viscera and organs primarily affected."

LAVERAN (A.). **Au sujet de l'évolution des infections expérimentales des petits Rongeurs par *Leishmania tropica*.** [The Evolution of Experimental Infections by means of *Leishmania tropica* in Small Rodents.]—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 110–113.

In this article Laveran criticizes BOUILLIEZ's memoir (extracted above). Although the two authors are in agreement on many points their opinions differ as to the sequence of the pathogenic effects produced by *Leishmania tropica* in small rodents. Laveran then details some experiments performed on white mice with the virus in his possession. It is admitted that the virus employed by BOUILLIEZ might have shown greater activity. The author concludes that with the virus of oriental sore which he used in inoculating white mice intraperitoneally or into the peritesticular connective tissue the local effects, ordinarily manifested by the presence of a testicular swelling, precede the general infection; this, moreover, may be altogether absent when an early post-mortem examination is made.

(c) PIROPLASMOSIS.

SPARAPANI. **Trasmissione dell' infezione da *Piroplasma ovis* in tre suini per via digerente.** [Transmission of *P. ovis* to Three Pigs by Ingestion.]—*Pathologica.* 1917. Jan. 15. Vol. 9. No. 196. pp. 21–22.

Three young pigs in a poor jaundiced condition were brought in for slaughter and on post-mortem examination the usual changes accompanying parasitic blood destruction were observed, viz., swelling and softening of the spleen, enlargement and yellowish colour of the liver, congestion of the kidneys, dark red urine in the urinary bladder, and petechiae on the various mucous and serous membranes.

Smears from the peripheral blood stained by Giemsa showed numerous red corpuscles invaded by a piroplasm which from its structure, form, and dimensions was identified as *P. ovis.* It was found on enquiry that a couple of months previously these three pigs had eaten several times the flesh of sheep which had died in their pens. Examination was then made on the farm of blood smears from sheep which were clinically suspected of being affected with piroplasmosis on account of their poor condition and yellow mucous membranes, and in some of these smears numerous corpuscles were found invaded with *P. ovis.*

Though the great majority of observers assert that piroplasmosis is transmitted only by the bites of ticks the author quotes in support of his own observation the results of NAWROTSKY's experiments in infecting dogs by the direct administration of piroplasm-containing blood into their stomachs; also, LANFRANCHI demonstrated the transmission of *T. brucei* and *gambiense* to pups sucking bitches artificially infected.

VAN SACEGHEM (R.). **Cas suspects d'*East Coast fever* au Congo.** [Suspected Cases of East Coast Fever in the Congo.]—*Bull. Soc. Path. Exot.* 1917. Mar. Vol. 10. No. 3. pp. 172–173.

The author observed at Zambi, Lower Congo, in bovines an affection which showed clinical symptoms and lesions corresponding exactly with those of East Coast fever, but in which he failed to demonstrate the presence of Koch's blue bodies. The symptoms were fever, inappetence, stiffness, progressive paresis of the hind quarters, and enlargement of the glands; there was no haemoglobinuria. In some cases the animals were observed to be quite healthy in the morning, become paralysed in the evening, and die during the night.

On careful examination the possibility of trypanosomiasis, piroplasmosis, anaplasmosis, or poisoning was eliminated.

On post-mortem examination the liver was found to be enlarged and yellowish in colour; the lymphatic glands were enlarged and haemorrhagic; the kidneys and liver were scattered with yellowish-white infarcts, the spleen was not hypertrophied, and the intestine was affected with a haemorrhagic enteritis. In the red blood corpuscles a very few rod-shaped bodies identical in shape with Theileria were discoverable; no Koch's blue bodies were found. The disease terminated in death in all the infected animals and the mortality in the course of a few months rose to 40 per cent. of the cattle of the district.

LEGER (M.) & MOUZELS (P.). **Piroplasme et microfilaire d'un Edenté, le *Bradypus tridactylus* Linn.** [Piroplasm and Microfilaria of an Edentate *Bradypus tridactylus* Linne.]—*Bull. Soc. Path. Exot.* 1917. Mar. Vol. 10. No. 3. pp. 173–176.

In the edentates of French Guiana MESNIL and BRIMONT have described the following haematozoa, viz., an endotrypanum and a trypanosome of *Choloepus didactylus* (two-toed sloth), a trypanosome and a microfilaria of *Tamandua tridactyla*, and a microfilaria of *Bradypus tridactylus*, commonly known as "Ai" (or three-toed sloth).

In the red blood corpuscles of a wild specimen of the last-named species caught by the authors a piroplasm was also discovered. The parasites were fairly numerous and presented different appearances. The most common form was from ·5 to ·8μ in diameter, oval, and almost entirely filled up with an irregularly shaped nucleus staining deeply red. Other parasites were from 1 to 2μ, pear-shaped or oval, and containing a nucleus which was sometimes compact and sometimes represented by a slender filament which assumed very variable shapes. Very rare bacillary forms also were seen, some of which were about 1μ and truly rod-shaped, and others slightly curved, about 2μ in length and match-shaped. The multiplicative forms remained small in size and hardly ever exceeded 2μ in diameter. The chromatin became separated out into from two to six small masses and when segmentation was complete each nucleus was surrounded by a scarcely visible protoplasmic zone.

The red corpuscles invaded were of normal size and appearance while the other corpuscles also presented no changes in morphology or staining-reactions. No anaplasma-like bodies were seen. The leucocyte count was normal.

It was exceptional to find more than one parasite in the same corpuscle and the organism was disposed rather towards the periphery of the corpuscle. Smears from various organs showed no particular abnormality and no bodies similar to Koch's blue bodies were discoverable.

According to the authors the parasite falls into the genus Theileria, created by BETTENCOURT, FRANÇA, and BORGES (1907) for piroplasms of which certain elements are bacillary in form and which in dividing give rise to daughter elements in the form of a cross and very poor in cytoplasm. The authors give the name *Theileria brimonti* to this new species.

A tick belonging to the species *Amblyomma varium* Koch was found on the affected animal.

In smears from the blood and especially from the lung of the above animal a microfilaria was discovered which was identified with *Microfilaria kerandeli* Brimont. The dimensions were as follows :—cephalic spot $4{\cdot}5\mu$, from this up to the first clear space $37{\cdot}5\mu$, from this up to second clear space 23μ, second clear space 5μ, from this up to posterior extremity 105μ.

(d) SPIROCHAETES.

MACFIE (J. W. Scott). **The Morphology of Certain Spirochaetes of Man and other Animals.**—*Ann. Trop. Med. & Parasit.* 1916. Dec. 16. Vol. 10. No. 3. pp. 305–343. With 6 figs. and 8 tables.

In the introduction to this article the author discusses the measurement of the lengths of spirochaetes as a test of species. It appears to be extremely difficult to distinguish the smaller spirochaetes by morphological characters and in the case of any one species the staining reactions, thickness, and structural characters vary with the chemical composition of the surrounding medium and the method employed in putting them in evidence. The technique of cultivation is moreover laborious and difficult.

Length is perhaps the morphological character which promises to be of greatest assistance in identification, notwithstanding the fact that considerable variations are known to occur in a single species. The method proposed by the author is to draw a large number of spirochaetes with the aid of a camera lucida, to measure the drawings either by the tangent line or compass method, and to plot the lengths as a curve. By this method the great majority of the spirochaetes of the same species are found to measure within a few microns of each other in length.

The measurements may be grouped in the following manner:—

"First there come a few very short forms, which are probably either abnormally small individuals or, in the case of spirochaetes possessing an intracellular phase, immature specimens that have been prematurely freed in the process of making the films. Then there come the normal single spirochaetes which form the dome of the curve and extend over a range of 3 or 4 microns. . . . This is . . . the characteristic length of the organism. Next come the pre-division forms and the forms already differentiated into two daughter spirochaetes, united end to end by a delicate filament; and at this point on the curve a small subsidiary crest or halt in the descent may be observed, due to the overlapping in length of large single and small double forms. Finally there come the abnormally long individuals, including hypertrophic specimens, unusually large dividing forms, incompletely divided organisms, and the multiple forms not infrequently met with in some cases."

The author then proceeds to employ this method in the identification of spirochaetes from the vagina, bladder, and pharynx in cases of human disease. The last part of the article, however, is more especially of veterinary interest and records observations on the intestinal spirochaetes of a number of the lower animals. Until quite recently, even the intestinal spirochaetes found in man had not been thoroughly studied, and with the exception of a few brief references the author was unable to discover any descriptions of the forms found in domesticated animals. [He appears to be unaware of the recent work of some American authors on the spirochaetes found in the intestinal tract and internal organs in pigs in cases of swine fever.—Ed.]. Our lack of knowledge appears to be due to the fact that hitherto these spirochaetes have been assumed to be non-pathogenic. The spirochaetes found on the surfaces of ulcerated lesions have also been regarded as saprophytic, but in some cases there is evidence that the organisms may spread beyond the superficial lesions and even become blood parasites. In the course of examining blood films from the Accra slaughterhouse in 1914, spirochaetes were occasionally found, viz., in 4 out of 166 cattle, 4 out of 95 sheep, 1 out of 94 pigs, and 1 out of 80 goats. The parasites were of types found to occur in the intestines of these animals and they were always rare in the films. " The intestinal spirochaetes are sometimes present in such enormous numbers that one cannot but suspect that they are not entirely harmless. In man they are often most abundant in cases of diarrhoea, and they are certainly suspected of being directly connected with this condition."

Monkey. Small spirochaetes were found in great numbers in smears made from the large intestine and rectum of a monkey (*Cercopithecus petaurista*) that had died of amoebic dysentery at Accra. When stained by Leishman's method the spirochaetes appeared extremely slender but when stained with gentian violet they appeared rather thicker, about $0{\cdot}2\mu$. The organisms were of the loosely-coiled type. The longest measured 9μ, the shortest 3μ, average $5{\cdot}42\mu$. When plotted the measurements formed a curve similar to that of *S. eurygyrata*—recently shown by Fantham to constitute the single species invariably found in human faeces—and it was concluded that this spirochaete of the monkey was morphologically identical with the human species.

Rats. The faeces of a few healthy rats (*Epimys rattus*) were examined and spirochaetes were found to be numerous in some of the animals, scanty in others, but the species of parasite appeared to be the same in each case. The length of the organisms varied from 2μ to 11μ, average $5{\cdot}27\mu$, and it was concluded that they could not be distinguished from *S. eurygyrata* by their morphological characters.

Sheep, cattle, goats, and pigs. A few spirochaetes from the faeces of these animals were measured. The average length was $4{\cdot}7\mu$ in sheep, $4{\cdot}7\mu$ in cattle, $5{\cdot}5\mu$ in goats, and $5{\cdot}2\mu$ in pigs. " Considering the small number of measurements made in each case, the lengths correspond fairly closely with each other and with those of rat spirochaetes and *S. eurygyrata*."

Dogs. In the faeces of an apparently healthy rough-haired terrier of European extraction an exceedingly heavy infection with minute spirochaetes was found. The same organism was also found in two native dogs. There was nothing characteristic about their movements, and structural details were difficult to observe on account of their smallness. Details are given with regard to the shape of the body and coils. The shortest length was 1μ, longest 5μ, average $2{\cdot}7\mu$. The spirochaetes were slender organisms and even the thicker ones were less than $0{\cdot}25\mu$ broad. The ends were tapering and generally sharply pointed. This spirochaete appears to be a good deal shorter than that described by other authors in dogs, the species described by some resembling *Treponema pallidum*. The spirochaetes described by BALFOUR in the stomach and intestines of dogs dying of experimental trypanosomiasis in the Soudan appear to have been thicker, much more closely and regularly coiled, and longer. The author proposes the name *Spirochaeta canis* for the species described by him.

Cats. The faeces of four cats were examined and in three a very small number of small spirochaetes were found, and these appeared to be identical with those described above as occurring in dogs. In the fourth cat two different spiral organisms were found, the one in the stomach and the other in the large intestine and rectum. The organism found in the stomach was not of the *S. eurygyrata* type. It was a relatively thick organism, so closely coiled that it resembled a screw with a narrow thread; the average breadth was about 0·4 or 0·5μ and the length was from 3 to 8μ, average 5·48μ. This organism was believed to be the same as that found by BALFOUR in the stomach of a dog and referred to above. In the stomach of the same cat a great number of small delicate-looking spirochaetes with pointed extremities, morphologically indistinguishable from *S. eurygyrata*, were found.

The author's conclusions are as follows:—

"1. Spirochaetes of the *S. eurygyrata* type have been found in the faeces of certain of the lower animals examined at Accra.

"2. The first type was found in a monkey, a cat, rats, sheep, cattle, goats, and pigs, and appeared to be morphologically indistinguishable from *S. eurygyrata*, the species found in man.

"3. The second type, for which the name *S. canis* is proposed, was found in dogs and cats. This was a smaller organism, measuring most commonly 2μ to 3μ in length, and about 0·2μ in breadth."

AKATSU (Seinai) & NOGUCHI (Hideyo). **The Drug-Fastness of Spirochaetes to Arsenic, Mercurial, and Iodide Compounds** ***in vitro***.—*Jl. Experim. Med.* 1917. Mar. 1. Vol. 25. No. 3. pp. 349–362. With 11 tables.

"It has been known for some time that in trypanosomiasis the trypanosomes which have survived the first effect of an arsenic germicide, such as atoxyl or arsacetin, offer a greater resistance to a subsequent dose of the same drug. By subjecting the organisms to repeated injections of an arsenic medicament, one tends to create, both in animals and in man, a strain or race which resists the arsenic chemotherapy to such an extent that the term arsenic-fastness has come into existence as a brief designation of the modified strain. A similar phenomenon has been observed in spirochetosis in fowls and mammals. Even with a typical bacterium, there seems to exist a possibility of raising the original resistance against a certain arsenic compound to a considerable degree, as was shown by Marks in his experiment with the paratyphoid bacillus, which he was finally able to cultivate in a medium containing eight times the amount of arsenious acid which the organism was able to withstand at the beginning of his experiment. Marks accomplished this within a period of three years by successive transplantations from a weaker to a gradually stronger concentration of the acid."

In this paper the experiments are directed mainly towards studying the effects of these drugs on the spirochaete of human syphilus, *Treponema pallidum*, but the results obtained are, however, of general interest. After enumerating the various methods of studying the sterilising effect of the preparations on this organism the authors state that the only practicable method is to determine the degrees of tolerance of pure cultures of *T. pallidum* to a given medicament by testing the organisms *in vitro* against gradually increasing doses of the drug. Details are then given with regard to the technique employed in carrying out this method.

The following is a summary of the results obtained.

"In the foregoing experiments we attempted to determine whether or not, by subjecting several varieties of spirochaetes to increasing doses of certain chemotherapeutic agents, a gradual increase of resistance to the latter could be shown. For this purpose, pure cultures of *Treponema pallidum*, *Treponema microdentium*, and *Spirochaeta refringens* were used against the action of salvarsan, neosalvarsan, bichloride of mercury, and iodine-iodide potassium solution *in vitro*. For culture media, the usual ascites-broth-tissue medium as well as solid ascites-agar-tissue medium was used. After permitting the spirochaetes to grow for a fortnight in media containing certain quantities of each drug, transfers were made from tubes showing various degrees of growth to the next series of tubes containing the same drug in still higher concentrations, and similar transfers repeated every two weeks. The results of the experiments may be briefly summarised as follows :—

"1. *Treponema pallidum* and *Treponema microdentium* have, within three to four months, increased their tolerance to salvarsan and neosalvarsan to five and one-half times their original mark. With *Spirochaeta refringens* the increase was about three times.

"2. Against the action of bichloride of mercury, the amount of increased tolerance of *Treponema pallidum* was about 35 to 70 times the original, while that of *Treponema microdentium* was about 10 times as much and was reached within 10 weeks. *Spirochaeta refringens* resisted 30 times the original dose.

"3. There was an unmistakable increase of resistance of these spirochaetes to the action of the iodine-iodide solution (Lugol's solution) when they were grown for several generations in fluid media containing the iodine solution, but the rate of increase between the initial and the acquired tolerance was slight. In general, the addition of Lugol's solution to fluid media has a weak inhibitory influence upon the growth of the spirochaetes, requiring for the total suppression of growth a quantity of over 0·7 c.c. to 5 c.c. of the culture media. The tolerance reached was for about three times that amount.

"4. A similar tolerance phenomenon has not been established when employing a solid instead of a fluid medium containing the drugs. No explanation is offered except a suggestion that the drugs held in the agar do not enter into combination with certain tissue constituents of the medium as they are able to do with tissue elements in fluid media. This may be a factor necessary for inducing drug tolerance in these organisms *in vitro*.

"5. The increased drug-fastness *in vitro* has a limit beyond which no further advance can be made. This limit varies with different species of spirochaetes.

"6. The acquired drug-fastness *in vitro* gradually disappears when the spirochaetes are cultivated again in the drug-free media for several generations."

KOLMER (W.) & WAGNER (R. J.). **Ueber eine im Magenfundus des Hundes vorkommende saprophytische Spirochäte.** [A Saprophytic Spirochaete found in the Fundus of a Dog's Stomach.]—*Centralbl. f. Bakt.* I. Abt. Orig. 1916. Oct. 12. Vol. 78. No. 5. pp. 383–384. With 1 fig.

Within the gland follicles of the fundus of the stomach of an apparently quite normal dog the authors discovered a very large number of spirochaetes in pure culture, which apparently produced no visible lesion. Histological examination also showed that there was nothing abnormal in the gland cells. The spirochaete was exclusively extracellular and occurred either singly or in tufts filling up the lumen of the follicles. It measured 10 to 12μ in length by about 0·25μ in breadth and always possessed 8 spirals, each of which was 0·7μ in depth and 1·2μ in length.

Reference is made of the discovery of spirochaetes (*Sp. regaudi*) in the normal stomach mucous membrane of dogs and cats by REGAUD (1909). BALL & ROQUET (1910), and LUCET (1910), described two kinds of spirochaetes in the stomach of a dog affected with gastro-enteritis, viz., a slender actively motile spirochaete, 5 to 10μ by 0·4μ, and another short thick form 4 to 7μ by 0·8μ. These organisms were not discoverable in the blood. The spirochaete dealt with in this paper is stated to be quite different in appearance from those described by these authors.

(e) TRYPANOSOMIASIS.

VELU (H.). **La Trypanosomiase des chevaux au Maroc. (Etude expérimentale.)** [An Experimental Study of the Equine Trypanosomiasis of Morocco.]—*Bull. Soc. Path. Exot.* 1917. Mar. Vol. 10. No. 3. pp. 253–260.

Reference has already been made to the author's observations on the above disease [see this *Bulletin*, 1916, March. Vol. 4. No. 1. p. 10]; its frequency and distinctive clinical characters were described. SERGENT, LHÉRITIER and BELLEVAL (1911) gave the name *Trypanosoma marocanum* to the causal organism [*loc. cit.* 1915. Sept. Vol. 3. No. 3. p. 84].

The author summarises the results obtained by inoculating various animals with blood containing the trypanosome from six different horses. The effects of inoculation and of passage on the various animals are depicted in the form of a genealogical chart.

The following are briefly the author's conclusions.

The trypanosome appeared to be very virulent for the white rat. After an incubation period of about 3 to 4 days this animal showed an acute infection which lasted on an average from 7 to 10 days. On post-mortem examination the spleen was found to be enormously enlarged.

The rabbit appeared to be only slightly affected. The disease took on a chronic form which ran a protracted and irregular course. The symptoms and the lesions were the same as in the case of all other trypanosomiases in this animal.

A considerable number of dogs were inoculated and it was found that the disease in the dog was sub-acute in character with frequent febrile crises. The presence of the trypanosome almost constantly in the blood makes observation easy when dogs are used as experimental animals.

In the case of two mules the course of the disease was relatively rapid as compared with that of the natural affection.

Two goats and two sheep inoculated did not present any trypanosomes subsequently in the peripheral blood nor any symptoms besides attacks of fever and wasting in condition. The two goats recovered, one at the end of thirteen months and the other at the end of twelve months; the infection could only be placed in evidence by the incoulation of large quantities of blood into dogs.

GREGGIO (G.). **Trypanose des porcs; relations des porcs avec la trypanose humaine dans la vallée de l'Inkissi (Moyen Congo belge).** [Trypanosomiasis of Pigs. Relations between Pig and Human Trypanosomiasis in the Inkissi Valley, Middle Belgian Congo.]—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 113–117.

In this article the author tabulates the results obtained on examination of smears from the blood of pigs brought to the Kisantu Market from various outlying districts from May to November, 1914. The trypanosome discovered was identified by RODHAIN as *T. congolense.*

The following were briefly the results obtained.

(1) Kisantu district (right bank of the Inkissi). Sixteen affected out of 50 examined, = 32 per cent.

(2) Tumba Mani district (right bank of the Inkissi). Fifteen affected out of 32 examined, = 46·8 per cent.

(3) District to the left of the Inkissi (opposite Kisantu). Five affected out of 12 examined, = 41·6 per cent.

This makes a total of 36 altogether affected out of 94 examined, = 38·3 per cent.

The following are, briefly, some of the deductions drawn by the author from these observations.

The infection has spread almost throughout the whole of the large valley of the Inkissi. The trypanosomes were very few in number in the blood. The trypanosomiasis causes no economic loss as the pigs show no external sign of disease and may be in very good condition.

There is no direct relationship between trypanosomiasis in pigs and in human beings in a certain district, and figures are given showing that the one may be very severe and the other almost entirely absent in a given place. Indirectly, however, serious dangers threaten the districts where pig-breeding has become extensive, on account of the fact that these animals favour the multiplication of Glossina and the most suitable places for rearing pigs are infested with the fly. In the district of Tumba Mani, for example, where pig-breeding has become very extensive, the villages are situated on the tops of hillocks surrounded by pastures consisting of short grass which makes it impossible for *G. palpalis* to propagate. The pigs kept in these villages are now able to find sufficient nourishment for themselves in the valleys and copses alongside the watercourses and are continually moving backwards and forwards to the huts in the villages, bringing along on their bodies a considerable number of *G. palpalis.* The percentage of total deaths due to sleeping sickness among the natives in these villages during the last few years has risen to 42·9 per cent., and the migration of *G. palpalis* on pigs appears to be the only explanation of this increase.

Mention is made of a similar occurrence in the Island of Principe, where, according to the Portuguese Commission on Sleeping Sickness, the role of pigs as carriers of *G. palpalis* was firmly established.

KOLMER (J. A.), SCHAMBERG (J. F.) & RAIZISS (G. D.). **Various Methods for determining the Trypanocidal Activity of Substances *in vitro* and their Relation to the Chemotherapy of Experimental Trypanosomiasis.**—*Jl. Infect. Dis.* 1917. Jan. Vol. 20. No. 1. pp. 10–27. With 15 tables.

—, — & —. **The Numeric Relationship of Infection to the Chemotherapy of Experimental Trypanosomiasis.**—*Ibid.* pp. 35–44. With 7 tables.

In the first of these papers the authors describe a series of rather elaborate methods for determining the toxicity of various chemical compounds on trypanosomes.

The first is called the microscopic method; a series of dilutions of the various compounds are added to blood containing trypanosomes obtained from white rats and the times required to kill the trypanosomes as observed by loss of motility and structural changes are determined by direct microscopic examination.

In the second method, which the authors call the "in-vitro-vivo centrifuge method," the trypanosomes are exposed for a certain interval to a definite dilution of the chemical, are then removed and washed by centrifugation and injected into the peritoneal cavities of white rats to determine whether their destruction has been brought about.

In another method called the "combined in-vitro-vivo method," equal parts of varying dilutions of the chemical under study are mixed with the blood trypanosome emulsion and kept at 37° to 40° C, and then the whole or a part of each is injected intraperitoneally into white rats to determine the degree of trypanocidal activity. As a part of the drug is injected the action of the drug is both in-vitro and in-vivo and due care must be exercised against the administration of lethal doses of the drug.

The most suitable trypanosome for use in the inoculation of rats for these experiments was found to be *T. equiperdum*. The results are displayed in a series of tables; the conclusions are as follows:—

"Trypanocidal tests in vitro have been found of distinct value in chemotherapeutic researches in experimental trypanosomiasis.

"Substances exerting a profound trypanocidal activity in vitro are likely to prove trypanocidal in vivo, provided the drug is sufficiently non-toxic to be administered in adequate dosage.

"With the combined in vitro-vivo method described herein, it has been found possible to detect the trypanocidal activity of new compounds which were without effect in vivo in amounts but slightly less than the sub-lethal dose.

"By the methods described herein arsenobenzol, or salvarsan, has been shown to possess a high trypanocidal activity in vitro.

"In vitro methods have also demonstrated a trypanocidal activity on the part of mercurials which is not apparent in the in-vivo tests."

In the second paper the method of study employed consisted in inoculating rats intra-peritoneally with a certain number (100,000 to 150,000 per rat) of *T. equiperdum* 24 hours before various doses of the drug were administered intravenously. The parasites were not usually found in the peripheral blood until 48 hours after injection or 24 hours after treatment. In this manner the infection was given a 24 hours start and was heavy enough to infect the controls in every instance, yet light enough not to mask finer degrees of therapeutic effect on the part of the drug under study. The conclusions are as follows:—

"These experiments demonstrated that in the chemotherapy of trypanosomiasis there is an important relationship between the number of trypanosomes injected into the test animal and the trypanocidal activity on the part of the drug.

"This relationship is particularly in evidence with respect to the amount of the drug necessary to effect complete sterilisation; while rats infected with 500,000 trypanosomes may be sterilised with 0·001 gm. of arsenobenzol per 100 gm. of rat, this is not the case when larger numbers of trypanosomes are injected.

"The influence of numbers is less marked when the rats are very heavily infected, as with numbers over 2,000,000. In these instances, arsenobenzol or salvarsan in dose of 0·001 gm. or 0·6 gm. per 60 kilogrammes of body weight retards the appearance of trypanosomes in the peripheral blood, but does not sterilise. The time of appearance of the parasites in the blood is likewise not greatly influenced by variation in the number used in inoculation.

"The numeric relationship of infection to the results of chemotherapeutic experiments is therefore of considerable importance, and more particularly in comparative tests."

RIECKENBERG (H.). **Eine neue Immunitätsreaktion bei experimenteller Trypanosomen-Infektion: die Blutplättchenprobe.** [A New Immunity Reaction in Experimental Trypanosomiasis: The Blood Platelet Test.]—*Zeitschr. f. Immunitätsforsch. u. Exper. Therap.* 1917. Jan. Vol. 26. No. 1. pp. 53–64. With 3 tables.

The technique employed is as follows.—

Rats are infected with a certain strain of nagana obtained from mice and when the trypanosomes in the blood are fairly numerous the rat is restored to health by the administration of tartar emetic, arsenophenylglycin, trixidin, etc. Three or four days after recovery a drop of blood from this rat is mixed with a drop of 2 per cent. citrate broth on a glass slide, and some trypanosomes of the original strain from a mouse are added quickly and well mixed, covered with a cover glass, and then examined under a high power dry objective.

The author claims that in addition to the usual phenomenon of agglutination one observes in such cases as this in about 15 or 20 minutes that the blood platelets become gradually attached to the trypanosomes, especially on the flagella; translatory movements are first inhibited and then the trypanosome becomes more and more immobile. A considerable mass of blood platelets is finally seen on the trypanosome when its movements have entirely ceased.

The author was able to show that certain free-lying platelets in the preparation belong to the non-immune mouse.

The serum obtained from the blood of such an immune animal when mixed with the trypanosomes and blood of another animal gave no blood-platelet reaction, but showed the usual agglutination reaction.

This blood platelet reaction was further shown to be different from the agglutination reaction inasmuch as the latter could be produced by the addition of the serum of a normal horse whereas no blood platelet reaction could be obtained in this way. The author then details at length experiments with a number of nagana strains maintained in German laboratories; tests on guinea-pigs, rats, and mice showed that the reaction was distinctly specific for each strain and also for each of the recurrent strains.

"In the blood of animals infected with experimental trypanosomiasis and afterwards cured or of animals subject to a chronic laboratory infection, antibodies are found which manifest themselves by the fact that rat or mouse trypanosomes in the citrated blood of these animals become loaded with blood platelets.

"This phenomenon is strictly specific for it only appears if a homologous strain of trypanosomes is employed in the test.

"By this test one can differentiate between the original and the recurrent strain. The reaction appeared in all cases in which an immunity against re-infection occurred."

RITZ (H.). **Ueber Rezidive bei experimenteller Trypanosomiasis. II. Mitteilung.** [Recurrent Infections in Experimental Trypanosomiasis. Second Report.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1916. Sept. 1. Vol. 20. No. 17. pp. 397–420. With 5 tables.

After discussing the significance of recurrent infections in trypanosomiasis according to various authors, Ritz details the technique employed by him in studying the various strains of trypanosomes produced in the course of recurrent attacks following infection by a single pure strain.

A rabbit was inoculated intravenously with a small quantity of blood from a mouse containing *T. brucei*, PROWAZEK strain, which had been isolated and maintained in mice in a pure state according to OEHLER's method.

On microscopic examination of this rabbit's blood a few trypanosomes were observed on the first three days after infection, on the 10th to the 12th day inclusive, and again in increasing numbers from the 24th to the 29th day, when the animal died.

Mouse inoculation was performed daily from the rabbit's blood. These gave positive results every day except on the 5th day after infection. The strains obtained on the first four days after infection and again on the nine days following the temporary disappearance of trypanosomes from the blood were kept running separately in mice and employed, together with the original strain used for infecting the rabbit, in a series of reciprocal cross-immunity tests on mice.

The mice used in these tests were infected intraperitoneally with the strain to be examined and then on the third day, when trypanosomes were numerous in the blood, cured by means of an intravenous injection of neosalvarsan. The trypanosomes having then disappeared from the blood the mice were re-infected with the other strains to be tested and the subsequent absence of trypanosomes from the blood or a long-delayed infection indicated immunity, or the identity of the two strains inoculated into the mouse.

In the case of rabbits the author divides the clinical course of infection into three stages, viz., the initial stage, which commences immediately after infection and lasts three or four days, secondly the crisis, during which the trypanosomes may disappear completely from the blood for up to three days as shown by mouse inoculation, and thirdly, the recurrence or the relapse, when the trypanosomes can be demonstrated daily up to death.

By means of the mouse cross-immunity tests it was found that trypanosomes which appeared during the initial stage were identical with each other, and with the original strain.

The results, however, obtained in the tests with recurrent strains are very complicated. The first, third, fourth, fifth, seventh, and ninth day recurrent strains were tested against each other and against the original strain. The results as shown in the tables are briefly as follows :—

Mice immune to the original strain showed no immunity towards any of the recurrent strains.

Mice immune to the first day recurrent strain showed no immunity towards the original or any of the other recurrent strains except that a slight delay in infection was noticeable in the case of re-infection with the third day strain.

Infection with the third-day recurrent strain produced immunity against itself and the first day strain and a slight delay in the case of the fourth day and fifth day strains, and negative results towards the original and the other recurrent strains.

Infection with the fourth day recurrent strain produced immunity against itself and the first day strain and a slight delay in the case of the third, fifth, and seventh day recurrent strains.

Infection with the fifth day recurrent strain produced immunity against itself, the first and the sixth day strains only.

Infection with the seventh day recurrent strain produced immunity against itself and the first day strain and a slight delay in the case of the second day strain.

Infection with the ninth day recurrent strain produced immunity against itself only, and a slight delay in the case of the seventh day strain.

Control mice inoculated with these strains died in all cases on the fourth or fifth day after infection.

The author enters into a long discussion on the significance of these results. His views are briefly that changes take place analogous to those in which "drug-fast" trypanosomes are created. Owing to trypanosome-immune bodies which tend gradually to destroy the strain or strains of trypanosomes present being produced in the serum of the infected animal, "serum-fast" forms are continually appearing and these new strains show different properties to the original strain and to the forms previously formed during the recurrent attack. In the course of a recurrent attack there are thus continually produced in the blood a very large number of new "serum-fast" strains which are probably responsible for the ultimate death of the animal.

SCHUSCHA (A. T.). **Ueber die Wirkung von Emetinum hydrochloricum auf Trypanosomen.** [The Action of Emetine Hydrochloride on Trypanosomes.]—*Cent. f. Bakt.* 1. Abt. Orig. 1917. Mar. 31. Vol. 79. No. 4. pp. 180–183. With 5 tables.

In view of the apparently specific action of emetine in amoebic dysentery, the author performed a few experiments to ascertain whether the drug had the same effect upon trypanosomes. In these experiments mice were inoculated with a strain of *T. equiperdum* which ordinarily produced death in from 7 to 14 days. The toxic dose of emetine was found to be about 0·002 gramme per mouse.

A sub-lethal dose (0·001 gramme) injected on the third day after infection, when trypanosomes first appeared in the blood, was found to have no curative effect, although death occurred in the treated animals two or three days later than in the case of the controls.

Even when injected early, that is, before the appearance of trypanosomes, the drug failed to prevent death. Death, however, was delayed for about ten days when the drug was administered on the day following the inoculation, and approximately the same results were obtained when the drug and the trypanosomes were injected simultaneously.

The author concludes that emetine hydrochloride has only a small protective action on mice after infection subcutaneously with trypanosomiasis (*T. equiperdum*). A curative action, as in the case of amoebic dysentery, does not exist; the action of the drug on the latter disease appears to be quite specific.

SWEZY (Olive). **The Kinetonucleus of Flagellates and the Binuclear Theory of Hartmann.**—*Univ. California Publicat. Zool.* 1916. Mar. 16. Vol. 16. No. 15. pp. 185–240. With 58 text figs.

"Summary.—1. The 'kinetonucleus' is a structure which, in the trypanosomes at least, is not composed of nuclear chromatin, nor can nuclear behavior, shown in mitosis, be claimed for it. It is a structure correlated with an endoparasitic mode of life, and is part of the extranuclear motor apparatus, which, in those cases where its origin can be traced, arises from the blepharoplast, and not by a division of the nucleus.

"2. The 'kinetonucleus' has been developed phylogenetically along two lines: first, from a uniflagellate ancestor possessing a simple basal granule, producing *Trypanosoma, Crithidia* and *Herpetomonas*; second, from a heteromastigote ancestor, also exhibiting only a simple basal granule, along the line of *Prowazekia, Polymastix, Trichomonas*, and the Trichonymphida.

"3. The chromidial body of *Prowazekia* arises as an outgrowth from a simple basal granule. Different stages in its development can be traced from this condition to the 'kinetonucleus' of *P. cruzi*, followed by its backward migration to a position posterior to the nucleus. The various forms which it assumes are all different aspects of the same structure, morphologically and functionally equivalent to the 'kinetonucleus' of the trypanosomes.

"4. The next stage in the development of the 'kinetonucleus' has produced, by a course of parallel evolution along two different lines, organelles in *Polymastix* and *Trypanoplasma* similar in their morphology and behavior in division. These are accessory kinetic structures comparable to the 'kinetonuclei' of the haemoflagellates.

"5. A slight modification of the long, band-like 'kinetonucleus' of *Prowazekia lacertae* is found in the chromatic basal rod of *Trichomonas*. This is an accessory structure intimately related to the blepharoplast and the entire neuro-motor apparatus and probably kinetic in its function, and hence an organelle homologous with the 'kinetonucleus' of the trypanosomes.

"6. A further development of the 'kinetonucleus' is found in the parabasal bodies of the Trichonymphida, a group phylogenetically close to *Trichomonas*. These bodies are accessory kinetic structures and in every respect comparable with the same organelles found in the other flagellates.

"7. This structure is not the kinetic center of the cell, but is an accessory part of the motor apparatus, a kinetic reservoir, hence the term 'kinetonucleus' denotes a wrong interpretation of its function, as does also the name blepharoplast, which is reserved for the definitive basal granule of the flagella plus the centrosome in some cases at least. As a more appropriate substitute for these names, and one which better indicates its probable relations in the cell, is suggested the term 'parabasal body,' first proposed by Janicki for these organelles in the Trichonymphida. Its application is here considerably extended.

"8. The binuclear theory of Hartmann and the foundation of the order Binucleata, rest upon three main propositions, namely, that the 'kinetonucleus' is composed of nuclear chromatin, that it originates by division of the trophonucleus, and that it divides by mitosis. These facts are contradicted by the results of careful investigations on both the Haemoflagellata and Haemosporidia, where these conditions are claimed to occur, which show, (i) by actual experimental proof, that the 'kinetonucleus' is not composed of nuclear chromatin, (ii) that in no single instance has it been found to arise by division of the nucleus, and (iii) that in no instance has a process of mitosis been found which could be correlated with division of the other organelles and with the cell.

"9. The Haemosporidia are affiliated with the Haemoflagellata neither morphologically nor by a comparison of the developmental data of the two groups. On the contrary, they are more nearly allied to the Coccidia and should be retained therewith in the Sporozoa.

"10. The order Binucleata, being founded on false premises and composed of families totally unrelated either morphologically or phylogenetically, should not be retained as a valid order of the Mastigophora."

(f) Miscellaneous.

Leger (Marcel). **Observations sur quelques Leucocytozoon d'Oiseaux de la région de Reims.** [Observations on Some Leucocytozoa of Birds in the Neighbourhood of Rheims.]—*Bull. Soc. Path. Exot.* 1917. Jan. Vol. 10. No. 1. pp. 28–33.

(1) Leucocytozoon parasites appear to be very common in the blood of crows (*Corvus corax*). Out of 15 birds examined 12 were found affected, for the most part intensely. The infection appears to be very severe in nestlings. The Leucocytozoon is of a rounded type measuring from 12–14μ in diameter and has an oval nucleus which nearly always contains at its thinner extremity a rod-shaped or spherical kinetonucleus. The nucleus of the invaded cell usually forms a crescent embracing in its concavity more than half the haematozoon. The author found that the host cell was a mononuclear leucocyte and was able to prove that the red corpuscles were not invaded, as insisted upon by some authors, by pouring the blood into slightly acidulated water.

Small oval or elongated elements were seen measuring from 1 to 2μ, containing a relatively large red-stained nucleus surrounded by the blue-stained protoplasm. These were richest in the lungs and bone marrow. The next forms, which had grown from 2·5 to 4μ, were found adherent to a depression in the nucleus of the host cell. The growth of the parasite is then very rapid and the nucleus is pushed towards the periphery of the cell but is not disintegrated.

The formation of microgametes was observed when blood had been collected in a solution of potassium oxalate, although this could not be observed in pure blood. The liberated flagella were found to be very active.

In the bone marrow of crows certain forms were observed which seemed to belong to the multiplicative stage of Leucocytozoon.

(2) Leucocytozoon were also frequently found in the common magpies of the Champagne district (*Pica melanoleuca*). The parasite was identified with *L. berestneffi* Sambon, 1908, described by Sakaroff in Transcaucasian magpies, 1893.

(3) A Leucocytozoon parasite was also found in a screech owl (*Asio accipitrinus*), and the author believes that this parasite is identical with *L. ziemanni* Laveran, 1902.

YAKIMOFF (W. L.) & SAPHRONOWITSCH (R. A.). **Parasites du sang des animaux en Transcaucasie.** [Blood Parasites of Animals in the Transcaucasus.]—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 98–100.

(1). Grahamella in rodents of the Caucasus.—This protozoon was found in the blood of a hamster (*Cricetus phoca*) and in a species of field mouse. In stained specimens the parasites appear as rod-shaped organisms measuring from 0·75 to 1·5μ, variable in number, but sometimes very numerous, and staining a violet-blue colour. No visible ill-effects were produced on the hosts. Anaplasms were also observed in the field mouse. The name *G. ninae kohl-yakimovi* is given to the parasite of the hamster.

(2). Theileria in the field mouse.—The blood of several of these animals in the district of Kars was examined and in all presented distinct polychromatophilia, but no poikilocytosis or normalblasts. In one case the authors discovered small rounded intra-corpuscular elements each consisting of protoplasm staining blue and a peripheral nucleus occupying nearly half the parasite. No pear-shaped or rod-shaped elements were observed. These bodies are identical with similar forms found previously by Yakimoff. The name *Theileria rossica* is given to these elements.

(3). Leucocytogregarina of a fish.—Gregarines have recently been frequently discovered in the leucocytes of mammals, but none have hitherto been described in the leucocytes of fishes although they have been found on several occasions in the red corpuscles. In the fish examined the gregarine was found inside a large mononuclear; it measured 9μ by 4·5μ and possessed one rounded and one elongated pointed extremity. The name *Leucocytogregarina ninae kohl-yakimovi* is given to this parasite.

LEGER (M.) & MOUZELS (P.). *Plasmodium* **de** *Iguana nudicollis.*—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 95–98.

The small lizards of the species *Iguana nudicollis* Cuvier found in Guiana are often observed to harbour a Plasmodium which invades the red blood corpuscles without producing in them any deformity or change in the staining reactions. A single corpuscle may contain two or three parasites.

Asexual elements.—The youngest form, which is also the form most commonly found, consists of a minute body scarcely 1μ in diameter made up almost entirely of a nucleus containing a brightly staining karyosome towards its periphery. The growing stage presents a variety of appearances—ring-shaped, sometimes pear-shaped, dumb-bell-shaped, rod-shaped, etc.—and often containing in addition to the nucleus a very dense coarse chromatin particle staining garnet-red. The adult form becomes amoeboid or lozenge-shaped and never exceeds 5μ in diameter. The nucleus usually disappears and the chromatin forms a diffuse network in the protoplasm and later becomes divided into three or four small masses placed towards the periphery of the parasite. The above forms rarely show any pigment granules. Segmentation of the schizonts never takes place in the circulating blood but can be observed in the organs, especially in the lung. These dividing forms are found outside the corpuscles, and are regularly rounded in appearance, measure from 5 up to 7μ, and contain an abundance of dark brown pigment. Schizogony thus takes place with the formation of four merozoites.

Sexual elements.—The gametes are fairly numerous in smears from the organs especially from the spleen but are extremely rare in the peripheral blood. They are always outside the corpuscles. Macrogametes are rounded or oval, from 3·5 to 6μ in diameter with a centrally placed chromatin mass and contain a very abundant black irregular mass of pigment. The microgametocytes are rather smaller in size and the nucleus is made up of loose lightly staining chromatin; the pigment is made up of greenish-brown short rods.

A form believed to be a female element undergoing parthenogenesis is also described. No periodicity was observed in the schizogonic cycle when the blood was examined for several days. Reference is made to other species of plasmodium found in lizards by Carini, Wenyon, and other observers, but the parasite described in this paper is said to bear a close resemblance to *Pl. praecox* found on the West Coast of Africa and *Pyrhemocyton tarentolae* Chatton & Blanc. The name *Pl. carinii* is proposed for this new species.

Yakimoff (W. L.). *Prowazekia ninae kohl-yakimovi*—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. p. 101.

This protozoon was discovered in infusions of hay from various parts of Russia. It possessed one principal nucleus, a blepharoplast, and an anterior and a posterior flagellum, each with one or more basal granules. The parasite was cultivable on Frosch's and Musgrave and Clegg's agar.

Yakimoff (W. L.) & Schokhor (N. J.). *Leucocytogregarina musculi* **A. Porter à Pétrograde.**—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 100–101.

A leucocytogregarine was discovered by Porter (1908) in mice in London and later by Sangiorgi (1912) in Turin.

This parasite was found by the author in smears from the organs of a mouse at Petrograd, and he believes it to be identical with the organism described by Porter and Sangiorgi.

DISEASES DUE TO METAZOAN PARASITES.

Yakimoff (W. L.) & Collaborators. **Microfilaires des animaux au Turkestan russe.** [Microfilariae of Animals in Russian Turkestan.] —*Bull. Soc. Path. Exot.* **1917.** Feb. Vol. 10. No. 2. pp. 102–105.

Reference has already been made to microfilariae described by the authors in horses, asses, mules (*Microfilaria ninae kohlyakimovi*), and camels (*Mf. camelensis*). [See this *Bulletin*, 1916. June. Vol. 4. No. 2. p. 69.] In this article microfilariae are described in the following species of animals.

(1). *Dogs.* The blood of 597 dogs from various districts was examined and 61 were found infected (10·21 per cent). The monthly infection was as follows :—March, 4 per cent, April, 4·1 per cent., and May, 14·1 per cent. The parasite measured from 245·44 to 333·70μ in length, by 7·16 to 8·52μ in breadth. It had the same appearance as microfilariae in other animals except that the sheath could not be stained. It usually contained five clear spots. A description is given of the internal structure of the parasites and differential blood counts of the host. The microfilaria is stated to be identical with *Mf. immitis*. Sometimes adult filariae were found in the heart and large blood vessels. The intestinal contents of Hippoboscidae caught on the dogs disclosed microfilariae.

(2). *Bovines.* Examination of the peripheral blood of 316 animals at the slaughterhouse failed to disclose any microfilariae. The affected seat was, however, later found to be the liver. Examination of the peripheral blood of a further series of 1,019 animals revealed filarial embryos in two cases. In the livers of 510 animals examined the parasites were found in 43 cases (8·4 per cent.). The sheath of the parasite stained very well. It contained 3 clear spaces. Its measurements, including the sheath, were on an average 250μ in length by 8·25μ in breadth. Sometimes smaller parasites were found resembling the sausage-like stage of *Filaria bancrofti* in the thoracic muscles of *Culex fatigans* (Low). The parasite is believed to be identical with the embryo of *Filaria labiato-papillosa.*

No microfilariae were found in the peripheral blood of 1,173 sheep and 671 ewes, and in 106 sheeps' livers.

(3). *Frogs.* Small microfilariae were found in the blood of *Rana viridis*. The sheath was well developed and stained red. Including the sheath they measured on an average 46μ by 4·24μ. They contained closely packed nuclei.

LEGER (André). **Microfilaires d'oiseaux du Sénégal.** [Microfilariae of Birds in Senegal.]—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 106–109.

After reviewing the list of microfilariae already found in the blood of many species of birds in several parts of the world, especially in Africa, the author describes three new species discovered by him in the following birds in Senegal. The adult forms of the embryos were not discoverable.

(1). The Giant Heron (*Ardea goliath* Temminck).—The microfilariae found in this bird were surrounded with a compact sheath, measured on an average 220 by 3·5μ, contained several distinct nuclei, and possessed active wriggling but only slight translatory movements. The caudal extremity was hook-shaped and the posterior end blunted. The parasite showed no periodicity, and it apparently had no ill effect upon the health of the host.

(2). Snipe (*Gallinago nigripennis* Linné).—The microfilaria was very rare in the blood. It measured 130 by 14μ, contained distinct cellular nuclei, was surrounded by a compact sheath showing no striation of the cuticle, and the posterior extremity was elongated and slender; it presented only slow creeping movements.

(3). The Large White-Throat (*Crateropus platycercus* Swainson).—In one bird examined an extremely severe infection was found (from 7 to 10 per field of the microscope). Morphologically these were found to belong to two different species.

The first was very closely ensheathed, measured 250 by 5·5μ, and presented very little activity, its movements being rather leech-like; it contained packed distinct nuclei, its posterior extremity was bulbous and the central clear spot was very apparent.

The second microfilaria was much smaller in size (80 by 5·5μ) and much less numerous in the blood (1 to 25 or 30 of the former). It was not ensheathed and it exhibited extremely rapid translatory movements. The cellular nuclei were indistinct, there was no striation of the cuticle, and the posterior extremity was blunted.

CLELAND (J. B.), DODD (S.) & FERGUSON (E. W.). **Further Investigations into the Etiology of Worm Nests in Cattle due to *Onchocerca gibsoni*. No. 2.**—*Commonwealth of Australia Publication.* 41 pp. Melbourne: Albert J. Mullet, Govt. Printer.

The investigations forming the subject of this communication are a continuation of those previously carried out in the State of New South Wales; details of previous experiments carried out by Cleland in conjunction with various authors have already been published in Government Reports commencing in July, 1913. The experimental work was carried out at Milson Island where conditions appeared favourable for work on account of the natural infestation with worm nests of the herd of cattle kept on the Island. From previous experiments carried out in this locality it seemed very clearly indicated that the vector was a flying insect, and that it probably was either *Stomoxys calcitrans* or one or more species of mosquito or of tabanids. The preponderance of evidence seemed to be in favour of Stomoxys and special attention was thus directed to this insect.

Three fly-proof cages for the accommodation of susceptible clean calves were erected and full details are given with regard to these structures.

Into one of these cages were placed two calves following each other at about three months interval; large numbers (about 11,000) of Stomoxys that had fed on infected cattle or on worm nests from the abattoir were introduced at short intervals over a period of three and six months respectively for the first and second calf. Notwithstanding the feeding of such large numbers of Stomoxys, of which some at least would be infected with Onchocerca larvae, it was found on slaughter that neither of these calves contained worm nests.

A similar experiment was simultaneously carried out in order to ascertain the role of mosquitos as possible vectors. Large numbers (over 2,000) of mosquitoes nearly all belonging to the species *Culicelsa vigilax*, and a few *Scutomyia notoscripta*, *Culicelsa annulirostris*, and *Stegomyia atripes*, were fed first on infected material as above and then introduced at various short intervals into the fly-proof cage. No worm nests were discoverable in these calves on post-mortem examination.

In the adjoining fly-proof cage one control calf was kept during these experiments and a few tabanids caught on infected cattle introduced. No worm nests were subsequently discoverable on slaughter.

Another control calf was kept in a pen where it was exposed to the attacks of flies and also to direct contact with the infected cattle. After nearly a year this calf was killed and on careful search a small worm nest was detected near the sternum, under the oblique muscles over the abdomen. A detailed account of the flies prevalent at various times during this exposure are given.

A further series of miscellaneous experiments with various diptera were performed.

Experiments to test the life of the larvae from worm nests placed in cow dung showed that they were not capable of surviving for 24 hours. Owing to the short life of the larva outside the body and also in view of the fact that no permanent natural water existed on the island it seems improbable that a water or moisture dwelling invertebrate is the intermediate host.

Transmission by the inbibition of secretions could only be effected by some species of Musca which are in fact extremely numerous on cattle in Australia. The life of the larval worm is, however, extremely short in these insects and no larvae have been found round the eyes, nostrils, and mouths of cattle where these flies commonly settle. In connection with the possible transmission by biting insects or other invertebrates the incidence and description of a long series of flies are enumerated.

The source through which *Onchocerca gibsoni* was introduced into Australia has previously been discussed by CLELAND and HARVEY JOHNSTON, who suggested that it had been introduced with buffaloes into the Northern Territory of Australia, and GILRUTH and SWEET, who considered that it had been introduced by means of ordinary cattle from Java or some other of the Malay Islands. The authors now state that " a further consideration of the sources from which cattle were imported into Australia in the early days of settlement, together with greater detail as to the distribution of worm nests in cattle in New South Wales, has made us reconsider both these possibilities and we have now come to the conclusion that it is by no means improbable that *Onchocerca gibsoni* reached Australia amongst the early importation of cattle from India into the neighbourhood of Sydney and from this source spread northwards with the distribution of cattle."

With regard to the probable vector the authors conclude that it is unlikely to be Stomoxys or mosquitoes but that it is probably some tabanid; the distribution of onchocerciasis seems to correspond with the prevalence of tabanids. Details regarding infested cattle on Milson Island conclude the paper.

VAN SACEGHEM. **Dermatose et gale démodectique des bovidés.** [Dermatitis and Demodectic Mange of Bovines.]—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 117–120.

The dermatitis which occurs among bovines in the tropics and is caused by *Dermatophilus congolensis* is often confused with bovine demodectic mange. These two skin affections are, however, easily distinguishable bacteriologically and clinically.

Demodex folliculorum var. *bovis* is characterised by the length of its rostrum and cephalothorax, which is almost equal to that of the abdomen. It was first described by GROS (1845), by FAXON (1878) in America, and GRIMM and OEHL in Germany.

The lesions produced by the demodex in Europe are mild, but in South America on the other hand losses are caused on account of the diminution in value of the hide.

GRIFFITHS (1915) describes severe lesions caused by the Demodex in bovines in Nyasaland.

A large number of cases of demodectic mange were observed by the author in the Belgian Congo both among European and native breeds as well as in Indian hump-backed cattle. The disease is characterised by the following clinical symptoms:—

(1) The presence of comedos from the size of pins' heads up to hens' eggs containing brownish matter, and no crusts; (2) the chronic and slowly progressive character of the disease; (3) no effect on the general condition; (4) young animals not affected; (5) occurrence in the dry season as well as in the rainy season in the tropics.

The spread of the disease was prevented by regular dipping in arsenical baths (sodium arsenite, paraffin, soap, and water).

Dermatophilus congolensis, the cause of tropical dermatitis in bovines, is a filamentous bacterium and appears in two forms (1) straight or curved filaments, sometimes branched and containing fine granules, (2) isolated cocci.

The disease is identified clinically by the following characters (1) the formation of crusts, the hairs over which are erect; (2) rapid spread over the animal; (3) complications which may bring about death; (4) young animals and adults affected to the same degree: (5) a seasonal affection which is only seen in the acute form during the rainy season. The specific treatment for this disease consists in the application of an ointment made of 5 per cent. carbolic acid in vaseline.

The two diseases may exist at the same time on one animal.

HADWEN (S.) & BRUCE (E. A.). **Anaphylaxis in Cattle and Sheep, produced by the Larvae of *Hypoderma bovis*, *H. lineatum* and *Oestrus ovis*.**—*Jl. Amer. Vet. Med. Assoc.* 1917. Apr. Vol. 4. No. 1. pp. 15–44. With 15 figs.

The results of numerous interesting experiments described in this paper are briefly summarised by the authors as follows:—

"Anaphylaxis has been reproduced in cattle, sheep, and small animals, with extracts of the larval forms of *H. lineatum*, *H. bovis*, and *Oestrus ovis*.

"The 'acute and chronic' forms have been reproduced, coinciding with Richet's definition.

"The reactions can be induced by crushing and returning an extract of an animal's own larvae into the jugular, showing that larvae living in the animals make them receptive.

"Natural cases of anaphylaxis are described where no injection had been given, and where injury had ruptured the larvae subcutaneously, liberating their contents in sufficient quantity to produce shock.

"A paper by Ries is reviewed in which the author ascribed the cause of infectious anaemia as being due to *Gastrophilus* sp.: it seems probable that he was dealing with reactions such as we describe.

"Animals which had recovered from the reaction were found to be immune for varying periods.

"The symptoms in 'acute' anaphylaxis were immediate; the first noticeable sign being an extremely tired look, succeeded almost immediately by salivation, tears and defaecation, then by signs of asphyxia, and death. In the 'chronic' form the symptoms were a little less rapid and not so severe, in addition there were edemas especially of the eyelids and anus, and marked irritation of the skin.

"Small animals were sensitized with warble extracts and showed signs of anaphylaxis following the second injection.

"Eye and other local reactions were obtained with extracts applied to the mucous membranes. In cattle the reaction was specific for extracts of *Hypoderma*, and in a horse for *Gastrophilus*.

"It would appear probable that similar reactions will be obtained in other animals with their own parasites."

RODHAIN (J.) & BEQUAERT (J.). **Matériaux pour une Etude Monographique de Diptères parasites de l'Afrique. Deuxième partie. Révision des Oestrinae du Continent Africain.**—*Bull. Sci. France et Belgique.* 1916. Nov. 25. Vol. 50. Nos. 1–2. pp. 53–165. With 29 figs. & 1 plate. [Reprinted from *Rev. App. Entom.* 1917. Apr. Vol. 5. Ser. B. Pt. 4. pp. 49–50.]

"This paper deals with the sub-family Oestrinae, which, in the authors' opinion, does not correspond entirely with the intestinal *Oestridae* of Brauer. They exclude the genus *Aulacephala*, Macq., of which the larval stages are unknown and which appears to be more closely allied to *Trixa*, B. B., as well as *Cephenomyia*, Latr., and *Pharyngomyia*, Schin., which they place, as does Girschner, in the Calliphorinae. The chief characters of the larva at the third instar, the pupa and the imago of the Oestrinae are given. On these characters this sub-family would include only the genera *Oestrus*. L., *Cephalopsis*, Towns., *Rhinoestrus*, Br., *Kirkioestrus*, R. and B., and *Gedoelstia*, R. and B. The authors consider a classification based on the characteristics of the larvae can be only a provisional one and is justified only where the adult insect is unknown. These genera form a homogeneous group and might reasonably be treated as sub-genera of a single genus *Oestrus*, L. The distribution of the spines in the larvae at the third instar are not considered to have more than a minor value in classification, as they are probably very variable in different individuals at the same stage in any given species.

"The larvae of the Oestrinae are parasitic in the sinuses of the bones of the skull of various wild and domestic mammals and have been met with accidentally in man. In the latter case they never attain their full development and, when present, are usually localised in the eyes, in which they cause conjunctivitis. Since the cavities of the skull communicate with each other and also with the throat, these larvae may occur in the pharynx and larynx, and have even been found in sheep in the bifurcation of the trachea down to the large bronchial tubes. This often occurs after the death of the host, but probably never does so in the living animal. In antelopes several larvae of different species are usually found at the same time. The larvae of *Oestrus*, *Gedoelstia*, and *Kirkioestrus* are found only among the hollow-horned ruminants, those of *Rhinoestrus* among the equines, pigs and hippopotamus, while those of *Cephalopsis* are peculiar to the camels. Information as to the different species and their respective hosts is given in detail in a table.

"The mode of nutrition of these larvae is not well known, but it is to be supposed that they feed on the mucus of the passages in which they are found. The importance of breeding them is emphasised, though hitherto all attempts to rear them to the adult stage in captivity have failed. The adult flies will not feed or pair in captivity.

"An account is given of the organism, *Herpetomonas oestrorum*, which parasitises these larvae. Six larvae of *Rhinoestrus nivarleti*, R. and B., taken from the same individual of *Potamochoerus porcus*, L., were all parasitised by a flagellate closely resembling and perhaps identical with this.

"A key to the genera of the Oestrinae is given and descriptions with discussions on synonymy, hosts, and geographical distribution of the following species:—*Cephalopsus titillator*, Clarke, *Oestrus ovis*, L., *O. aureoargentatus*, R. and B., and *O. variolosus*, Lw., *O. macdonaldi*, Ged., *Rhinoestrus nivarleti*, R. and B., *R. hippopotami*, Grünb., *R. purpureus*, Brauer, *R. phacochoeri*, R. and B., *Gedoelstia cristata*, R. and B., *Kirkioestrus surcoufi*, Ged., *K. blanchardi* and *K. minutus*, R. and B.

"A bibliography of 46 works is given."

Piot (J. B.). **Maladie des Tiques. Traitement préventif et curatif pour l'Egypte.**—*Bull. Union Agriculteurs d'Egypte*. 1916. Nov.-Dec. Vol. 14. No. 117. pp. 85–88. [Reprinted from *Rev. App. Entom.* 1917. Apr. Vol. 5. Ser. B. Pt. 4. pp. 51–52.]

"Cattle in Egypt, if left untended, frequently become entirely covered with ticks. It has been proved that infection in the tick is hereditary and that the piroplasm occurs in the salivary glands of the larvae, which can therefore directly inoculate the host. Piroplasmosis in cattle may be acute or chronic, the acute form being often responsible for a mortality as high as 80 per cent. The only curative treatment which the author has found to give complete satisfaction, other than quinine and trypanblue, is arrhénal; a hypodermic injection of one dose of one gramme is generally sufficient to allay the fever. This treatment to be effectual must be given as soon as the symptoms of the disease appear. Preventive measures should be directed against cattle sheds as well as against the cattle themselves. The earthen flooring should be frequently renewed and all cracks and crevices which could form a shelter for the female tick during oviposition should be filled up. A coat of quicklime should be given occasionally to the wall supporting the manger. Each animal should be thoroughly curry-combed, which is a far more effective method of removing all kinds of parasites than the use of any drug. By these simple means, the Administration have succeeded in reducing the cases of disease among their cattle to a minimum."

Fletcher (T. Bainbrigge). **Report of the Imperial Pathological Entomologist.**—*Rept. Agric. Res. Inst. & Coll. Pusa, 1915–1916.* Calcutta. 1916. pp. 78–84. [Reprinted from *Rev. App. Entom.* 1917. Mar. Vol. 5. Ser. B. Pt. 3. pp. 38–39.]

"Observations have been continued on the life-histories of various Tabanidae occurring at Pusa. Notes are given on the life-histories of *Tabanus nemocallosus*, the larvae of which are not, apparently, cannibals; *T. albimedius*, which is parasitised by a small Chalcidid, and has three broods annually; *T. striatus*, which also has three broods; *T. sanguineus*; *T. hilaris*; *Chrysops stimulans*, of which the larvae feed on dead earthworms and are probably also cannibals; the larvae of *Gastroxides ater* were found in hollows in tree-trunks.

"An account is given of transmission experiments with biting flies in the zone where surra is prevalent. *Tabanus albimedius* and *T. striatus* were found capable of transmitting the surra organism, not only by an interrupted feeding, but also by complete feeding. *T. albimedius* was proved to transmit surra 24 hours after feeding on an infected animal, but it failed to transmit disease after a longer interval. *T. striatus*, however, was found capable of transmitting surra (in one experiment with two flies) as long as 72 hours after feeding on an infected host. Smaller species, such as a *Tabanus* near *virgo*, were tried, but were not found to transmit disease. *Ctenocephalus felis* and dog and cattle fleas were also found incapable of transmitting surra. *Philaematomyia insignis* is only capable of transmitting surra in the case of an immediate interrupted feeding, the maximum interval, between leaving an infected host and commencing to feed on a previously uninfected animal, for which positive results were obtained, being only seven minutes, although positive results were obtained by direct inoculation of abdominal contents of infected flies as long as 28 hours after feeding on a surra-infected animal.

"Surra is not transmitted hereditarily to the progeny of infected females of *Tabanus striatus*, *T. albimedius*, or *Philaematomyia insignis*. . . ."

"Many maggots causing myiasis in domestic animals have been received and the flies bred out from them."

"Among the ticks received, *Ornithodoros savignyi* was under observation throughout the year. A species identical with, or near, *O. lahorensis* was received from Agra. Both were fed on goats."

Bouet (G.) & Roubaud (E.). **Répartition des Glossines à la Côte d'Ivoire.** [Distribution of Glossina in the Ivory Coast.]—*Bull. Soc. Path. Exot.* 1917. Jan. Vol. 10. No. 1. pp. 37–39.

In a former publication Bouet (1907) gave a few indications on this subject but he now admits that he was mistaken in identifying *G. morsitans* in the Ivory Coast. The true *morsitans* does not appear to exist in this colony and the species was in reality the nearly related *G. longipalpis*. The following is the distribution of the various species in the light of the authors' present knowledge.

From the coast up to latitude 6° N. *G. palpalis* and Glossina of the *fusca* group predominate. Between 5° 30′ and 5° 50′ is the only part of the fly belt where *G. pallicera* can be found and this part also contains almost all the *medicorum* and *nigrofusca* types identifiable in the colony.

Towards 6° 20′ a belt containing *G. longipalpis* commences and this extends and becomes absolutely predominant throughout the hinterland of the Ivory Coast up to the tenth degree, forming in connection with similar belts of the Gold Coast and of Togoland a large invaded tract between the coast and the Sudanese region. Towards the eighth degree *G. tachinoides* appears and predominates across the northern part of the colony.

Working northwards from the coast there are thus four principal Glossina belts, viz., a *palpalis* and *fusca* belt, a *pallicera* belt, a *longipalpis* belt, and a *tachinoides* belt.

Jack (Rupert W.). **Tsetse Fly Investigations, Sebungwe, August-September, 1916.**—*Report to Director of Agriculture, Salisbury, Rhodesia. British South Africa Company.* Dated 23rd September 1916. [MS. Report received in Colonial Office, November 27, 1916.]

The author journeyed in a south-westerly direction from Salisbury towards the Gwai River observing the extension of the area infested with tsetse especially along the water-courses traversed. It was found that the fly had spread rapidly in certain parts of the district, especially at the south-western corner of the big fly belt where the fly has advanced in a southerly direction from the Mzola to the Kana River, and in a westerly direction to the Shangani River, i.e., along the two confluent water-courses running into a stream which runs in a north-westerly direction into the Zambesi. The area around the confluence of these streams is not yet infested. The author believes that tsetse was carried down southwards from the upper stream, which is dried up in the dry season, to the lower one by means of large bands of game moving down to the latter stream in the evening to drink. A further spread southwards towards the Gwai River is anticipated. A large increase in the number of fly is reported at the head waters of the Mzola River, and extensions of the infested areas are noted in the neighbourhood of the Sengwe and Sasame Rivers.

In the course of observations on Meare's Farm (Sikombella River), evidence was obtained in support of YORKE's theory that trypanosomes of the *T. pecorum* type are capable of being transmitted from an infected to a healthy ox by some agency apart from tsetse fly. The oxen which had survived after visiting a known fly belt in October died in December following their return, and in the meantime transmitted the disease to twelve other oxen on the farm. In March five oxen again journeyed over a distance of 80 miles to another fly belt and on their return over 20 cattle contracted the disease on the farm. No tsetse fly could be found on the farm and the fly has not hitherto been discovered within a radius of 30 miles of the farm.

Experiments upon the effect of the exclusion of game upon trypanosomiasis are suggested and for this purpose the necessary arrangements are enumerated that would have to be made at Sipani Vlei, "an area which from its limited extent, intense infestation, and isolated position in the dry season, is admirably suited for an experiment."

ROBERTSON (Muriel). **Report upon the Present Conditions of the Siroko Valley, Mount Elgon.** Dated 21st January 1914.—19 pp. With 1 map. [MS. Colonial Office Report.]

The area investigated as to the distribution of *Glossina palpalis* from 17th November to 31st December, 1913 consisted of a number of valleys and water courses taking their origin from the eastern slopes of a short rugged ridge of mountains, the highest point of which is Mount Elgon, situated on the border between the Uganda Protectorate and British East Africa. The main stream—the Siroko River—takes its origin from the south-eastern slopes of the mountain, then runs in a northerly direction for a distance of over 30 miles, and becomes lost in marshy swamps. This river and two other small rivers which run together eastwards into it a few miles from its source are fringed with irregular, short, narrow strips of forest in which moderate numbers of tsetse were discovered; the fly was not however found at the upper parts of these rivers although the vegetation in many places appeared well adapted to harbour tsetse. No tsetse was found on the banks of the rivers originating to the north of the last-named rivers, nor in the marshes into which they emptied themselves. The main valley is continuous to the west with the great Kumi plain and is isolated from other fly areas. The distribution of the fly in the valley is indicated on the accompanying map.

1,004 flies were fed on two healthy dogs and one healthy goat with negative results. Dissections of the flies subsequently showed the presence of flagellates in the gut of 24; flagellates were also found in the proboscis of one of these but they were not attached and were few in number. These organisms were of the *T. grayi* type and "this type of flagellate forms no part of the life-cycle of any of the pathogenic group of mammalian trypanosomes;" they were most probably derived from the crocodiles which are very numerous in all these valleys. Nine inoculations were made into healthy dogs, of the blood of buck shot in the valley with negative results.

No case of sleeping sickness or of cattle trypanosomiasis has yet been reported in the valley and the author's observations indicate that "the mammalian group of trypanosomes has not yet arrived in the Siroko Valley fly-belts."

The valley is at present administered as a closed area in so far as the cultivation of the land and the building of permanent huts is concerned, but there is no attempt to exclude people entering the valley for hunting, fishing, etc.

The author points out that "an area opened under proper regulation achieves a more satisfactory level of safety than a similar area inefficiently closed." Moreover in this case the extent of the area to be cleared is not excessive nor is the clearing of a very difficult type. Measures are then suggested for repopulating the district. The most economical and efficient method of dealing with the conditions consists in "the temporary imposition of restrictions of intercourse and the gradual but complete clearing of the area by the population settled." There are already in existence schemes for the control of plague and of rinderpest and these might be adapted respectively to prevent the introduction of human and animal trypanosomiases.

The land in this district is for the most part very fertile and is much needed to relieve the congested population of other districts.

In the second part of the report Miss Robertson details points concerning the safe opening and administration of the district.

MYCOTIC DISEASES.

Epizootic lymphangitis.

Velu (H.). **La lymphangite épizootique; symptomatologie, d'après 300 observations personnelles.** [Epizootic Lymphangitis; Symptomatology according to 300 Personal Observations.]—*Bull. Soc. Cent. Med. Vet.* 1917. Mar. 1. *Rec. de Med. Vet.* 1917. Mar. 30. Vol. 92. No. 6. pp. 99–104.

"Epizootic lymphangitis is at present considered to be a disease of the lymphatics and mucous membranes, characterised always and exclusively by the presence of buds and cording of the lymphatics." This, however, does not correspond with the author's experience and he thus classifies the disease into two varieties, viz., (1) an atypical lymphangitis which remains localised in the inoculation wound, and (2) a typical lymphangitis which is manifested by cutaneous lesions (cording and buds) and sometimes by ulcers on the mucous membranes.

Atypical lymphangitis. The most striking characters of the lesions are, resistance to cicatrisation and the formation of fistulae without apparent cause. Very often the original fistula formed becomes constricted and small buds appear around it which later discharge and give rise to new fistulae often communicating with the original one. One finds on examination of these fistulae that they terminate in serious lesions—necrosis of bone, ligaments, or connective tissue —which account for their persistence and the abundant suppuration. The nature of this variety of the disease has hitherto been overlooked by practitioners as, owing to the favourable results following surgical operation, the lesions were supposed to be due to ordinary causes. Microscopic examination, however, invariably reveals the true nature of the disease and enables one to employ a specific treatment.

The various forms of this atypical lymphangitis observed by the author were as follows:—(a) simple shallow ulcers, of frequent occurrence, and (b) simple fistulous wounds, both occurring as complications of ordinary wounds; (c) a testicular lesion, as observed by TEPPAZ in the course of typical lymphangitis, was observed by the author in five cases of this atypical kind; (d) osseous lesions, observed 17 times; (e) conjunctival ulcers, observed in six cases, bi-lateral, and resembling summer sores in appearance; (f) cryptococcic phlebitis (one case); (g) cutaneous form (two cases) resembling contagious pustular dermatitis in appearance; these cases were characterised by the appearance of a small number of buds disseminated over the body and limbs and not united by visible lymphatic vessels.

Typical lymphangitis. In this form the resistance of the tissues apparently becomes broken down and invasion of the lymphatic vessels takes place from the original wound after an interval which may vary from a fortnight to six months according to the author's observations. This form is generally cutaneous, but it often affects the mucous membranes as a complication, following generalisation, or auto-inoculation.

The cutaneous form may be observed anywhere on the body and the course of the disease is always the same. From the original cicatrised or uncicatrised wound very prominent cords are seen along the lymphatic vessels making their way towards the nearest superficial lymphatic gland. Small intradermic swellings of variable size appear along their course giving them a beaded appearance. These swellings become extremely sensitive and the pain often causes great alterations in the temperament of the animal. The swellings after a very variable interval become converted into small abscesses and burst, the smallest discharging a greyish-red liquid which is sticky and can be easily spread out, and the largest abscesses discharging a laudable pus which is of a creamy, thick, mucous appearance, is not sticky and is spread out with difficulty. The very large deep-seated abscesses give rise to a less homogeneous, more serous-looking, pus.

After puncture the pus changes in character and each bud becomes an irregularly shaped protruding ulcer showing no tendency to cicatrisation and oozing a clear liquid from its surface. The inflammation of the lymphatic vessels disappears eventually leaving only the ulcerated buds and sometimes complications in the lymphatic glands, which may attain a considerable size, suppurate and become perforated with fistulae, discharging a pus extremely rich in cryptococci.

Lesions on the mucous membranes.—These most often appear as final complications in cases of generalised lymphangitis and according to the seats affected they assume very varied characters. On the lips and on the external wings of the nostril one finds small papules which may be mistaken for horse pox papules. After a few days these papules become transformed into pustules and ulcerate, small raised umbilicated ulcers remaining which discharge a colourless oily liquid. From the internal canthus of the eye a chain of small ulcers was observed in some cases to run up and down the head giving an appearance very similar to that of summer sores. On the conjunctiva, pituitary mucous membrane, and borders of the lips are sometimes seen ulcers which may, at first sight, be mistaken for those of acute glanders. The ulcer, however, is different in that its base protrudes and forms a prominence from 1 to 2 mm. in thickness on the mucous membrane. The ulcer is surrounded by a lightly coloured zone and it shows no tendency to cicatrisation. The ulcers sometimes become confluent and then give rise to a dull-white granulating mass. This condition leads to a painful swelling, and sometimes suppuration, of the submaxillary gland.

BOQUET (A.) & NÈGRE (L.). **Sur la culture du parasite de la lymphangite épizootique.** [Cultivation of the Causal Organism of Epizootic Lymphangitis.]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 274–276.

In preceding communications the authors claimed to have observed the development of the above organism in mycelial form in the water of condensation of various media. The medium which they now state to be the most favourable for growth consists of a filtered decoction of dried horse dung in water (400 grammes per 2 litres) containing 1 per cent. peptone, 1·8 per cent. agar, and 4 per cent. glucose. When pus taken from an unopened abscess is sown on this medium and incubated at 24° to 26° C. the cryptococci are found after 18 to 24 hours to increase in size and become rounded and granular. After 48 hours the rounded forms are filled with oily drops and throw out filaments which become segmented and attain a length of from 75 to 100μ. Although there was no visible growth the organism grew more rapidly and much more abundantly than on the other media formerly tried. Sub-cultures were, however, not obtainable on this medium and the growth of the mycelium in the original tube stopped after from 15 to 20 days.

It appeared that these failures might be due to the absence of pus in the sub-cultures and in order to make the conditions analogous to those on the original medium the authors smeared the surface of the horse-dung agar with a sterilised maceration of the lymphatic glands of a horse. Six weeks after inoculation a few very small colonies were observed, which increased slowly in size during the following fortnight both in the case of a primary culture and a first sub-culture. The colonies were spherical, projecting, wrinkled, and greyish, and became more and more adherent to the surface of the medium; the largest was about the size of a pin's head. The colonies were found to be composed of a tangled mass of mycelial filaments, granular in appearance, and often deformed by chlamydospores. At the extremities and on the walls of these filaments large rounded or oval cells were formed by a process of budding. The bud gradually became more and more constricted at its base and was then attached by a short narrow stalk to the mother cell before it finally became detached. These free double-walled cells then contained three or four elements identical with the cryptococci found in pus. These elements were so rare that the authors could not identify them by the usual staining methods, but morphologically they presented all the characters of the asci of ascospores.

The authors conclude that if these results are verified the causal organism of epizootic lymphangitis belongs to the genus Endomyces.

BACTERIAL DISEASE.

MASON (F. E.). **Tuberculosis in Camels.**—*Jl. Comp. Path. & Therap.* 1917. Mar. Vol. 30. Pt. 1. pp. 80–84.

"Tuberculosis appears to be very rare in camels living under normal or natural conditions in all countries except Egypt." Isolated cases have been recorded by LINGARD (1905) and LEESE (1908) in India, by ARCHIBALD (1910) in the Soudan, and also in Algeria.

In Egypt, however, since the first case was reported by LITTLEWOOD (1888), numerous cases have been recorded and the proportion of camels found affected at the Cairo abattoir, where during recent years up to about 2,000 camels are on an average slaughtered yearly for human food, varied from 1·63 to 5·4 per cent. in various years. The higher percentages have been noted since the war, when Egyptian camels only were slaughtered and no Syrian and Arabian camels, which previously were never found affected, were brought in.

The characters of the bacillus on culture and inoculation into small animals indicated that it is invariably of the bovine type. The source of the disease in camels can be easily traced to the custom of the fellaheen of keeping camels in close association with cattle. "All the evidence collected within the last six years tends to show that tuberculosis is not *par excellence* a disease of camels, but that infection takes place primarily from cattle."

The usual method of infection appears to be undoubtedly by inhalation and the lungs are invariably infected. Under ordinary conditions when diet is liberal and work moderate the disease runs a very chronic but progressive course. Under adverse conditions such as continuous transport work in the desert, rapid emaciation sets in with continuous fever, a profuse glairy discharge from the nostrils, pleurisy or peritonitis, and a firm swelling of the superficial lymphatic glands.

On post-mortem examination one finds that the lungs and bronchial glands are invariably infected; "grapes" are frequently seen on the pleura; the parietal pleura frequently escapes infection; the lesions in the lung may take the form of discrete miliary tubercles or a whole lobe may become consolidated and filled with caseous matter and fibrous tissue. There is a marked tendency towards the formation of fibrous tissue. The disease not infrequently produces pericarditis and peritonitis while lesions are not uncommonly also found in the liver, spleen, kidneys, and on the mucous surface of the trachea. Generalisation takes place in about 7 per cent of cases.

The lesions show the usual histology of tuberculous lesions with the exception that giant cells are rare. Tubercle bacilli are fairly easily discoverable. Calcification in a fine granular form sets in early.

The tuberculin test may be successfully employed. In connection with this test the author gives the following figures concerning the normal temperature of healthy camels at rest:—

"Extreme variation between early morning and late afternoon, from 35° C. (95° F.) to 38·6° C. (101·6° F.).

"At 6 a.m., 35° C. (95° F.) to 37·5° C. (99·6° F.); usual temperature 36·2° C. (97° F.).

"At 6 p.m., 37·4° C. (99·2° F.) to 38·6° C. (101·6° F.).

"A temperature over 37·5° C. (99·6° F.) at 9 a.m. is abnormal.

"A temperature over 38·7° C. (102° F.) at 6 p.m. is abnormal."

DISEASES DUE TO FILTERABLE VIRUSES.

(a) Rabies.

Konrádi (Daniel). **Die Vererbung der Immunitat gegen Lyssa. Dritte Mitteilung.** [Heredity of Rabies Immunity. Third Report.]—*Cent. f. Bakt.* 1. Abt. Orig. 1917. Jan. 30. Vol. 79. No. 2. pp. 80–82.

—. **Die Vererbung der Wut. Vierte Mitteilung.** [Heredity of Rabies. Fourth Report.]—*Ibid.* pp. 82–84.

In a former series of seven investigations Konradi demonstrated that immunity towards rabies was transmissible from the mother to the foetus [see this *Bulletin*, Vol. 2, No. 2, p. 94, and Vol. 4, No. 2, p. 62] and that this hereditary immunity is manifested only by the first generation and lasted ten months or longer.

Experiment 8. A bitch was immunised (3–5–1912) by means of a virus which had been submitted to a series of passages through a frog and through fifteen guinea-pigs successively; 2 grammes of the brain of the last guinea-pig were emulsified and injected under the skin of the bitch. The bitch subsequently showed no symptoms, but a guinea-pig inoculated sub-durally with this emulsion died in 52 days of typical rabies.

One hundred and ninety-five days (14–11–1912) after the inoculation the bitch gave birth to six pups, two of which remained alive.

One of the pups when nearly a year old (8–11–1913), was inoculated into the muscles of the back alongside the spinal cord with a dose of 1 c.c. of "street" virus. The dog remained alive and showed no symptoms of disease for one year. However, control animals, one dog and one guinea-pig, died after 26 days, and a rabbit inoculated sub-durally died after 20 days, of rabies.

The second pup was inoculated in the same way at the age of 2 years (13–11–1914) with the virus of human rabies. Twenty-four days afterwards (7–12–1914) it died of typical rabies. The mother's immunity was of still shorter duration as the bitch died subsequent to a test inoculation performed ten months (11–3–1913) after immunisation.

Experiment 9. A bitch was immunised (13–2–1914) with a virus which had passed successively through a series of eighteen rabbits, then through a fowl, and finally through a guinea-pig. The fowl died in 59 days after sub-dural inoculation and the guinea-pig in 94 days. The bitch was injected subcutaneously with 2 grammes of cord and subsequently showed no symptoms, but two control guinea-pigs injected sub-durally died in 20 and 22 days, respectively, of typical rabies.

In order to confer a still greater immunity the bitch was again inoculated (16–4–1914) with 2 grammes of cord containing virus which had successively passed through a fowl and through four guinea-pigs. This inoculation was also well stood, but a control guinea-pig died in 20 days of rabies.

The bitch had a litter of three pups (30–7–1914) of which two remained alive for observation. At the age of 1 year 8 months and 25 days (632 days) (24–4–1916), the two pups were simultaneously inoculated into the muscles of the back with "street" virus. Six months later they were still alive and well, but control animals inoculated in the same manner, viz., one rabbit and one dog, died after 20 and 39 days, respectively, of typical rabies.

The mother in this experiment also showed a shorter immunity, for it died of rabies after an earlier inoculation (11–12–1914).

The immunity of the two pups thus lasted for at least 632 days, which is much longer than Ehrlich and his successors accepted as a certain proof.

Experiment 10. A bitch was inoculated subcutaneously with an emulsion made from 24 grammes of cord containing virus obtained after 57 successive passages. The virus was kept for five days in carbol-glycerine with a view to attenuation, but when tested on a guinea-pig and a rabbit no weakening was found in reality to have taken place. On the 160th day after inoculation (4–4–1915) the bitch whelped a litter of four pups. These four pups died at the age of 14, 17, 30, and 34 days, respectively, all showing Negri bodies in the central nervous system and, in the case of the last two, typical symptoms of rabies.

Experiment 11. A bitch was injected (12–1–1915) subcutaneously with 4 grammes of guinea-pig cord containing virus which had passed first through a fowl and then through a series of eleven guinea-pigs.

Three days afterwards the mother gave birth to four pups. All four pups died, when 3, 15, 16, and 16 days old, respectively. Negri bodies were discoverable in all except the second pup that died, and in each case a guinea-pig inoculated into the muscles of the neck from the cord of a pup died of typical rabies in from 14 to 19 days.

In this case it was thus shown that the rabies virus appears as early as three days in the blood of the mother.

It is added that the mother had obtained no immunity for after a test inoculation on 7–4–1915 she died within 12 days of typical rabies.

Experiment 12. A bitch was immunised (31–1–1915) by subcutaneous inoculation with 3·5 gramme guinea-pig cord, the "street" virus in this case having been passed first through a fowl and then through a series of twelve guinea-pigs.

Forty-nine days after immunisation the mother aborted a well-developed foetus from which a guinea-pig was inoculated into the muscles of the neck. This guinea-pig died 15 days afterwards of typical rabies. The mother was inoculated twice (5–5–1915, and 15–1–1916) subcutaneously with an emulsion of guinea-pig cord as above for further immunisation and was still alive in October, 1916.

The author concludes that "from investigations made in this direction in the course of the last twelve years it is an established fact that the rabies virus is transmitted from the mother to the foetus."

(b) Rinderpest.

Shilston (A. W.). **Rinderpest. Preparation of Anti-Serum.**—*Agric. Res. Inst. Pusa. Bull. No. 64.* 1916. 18 pp. With 21 tables. 1916. Calcutta. Supt. Govt. Printing. India.

In this paper a series of experiments is summarily described performed with the object of raising the potency and effecting economies in the manufacture of anti-rinderpest serum at the Muktesar laboratory.

A comparative study of the yields resulting from different methods of separating serum from the blood has already been described in this *Bulletin* [see Vol. 4, No. 4, p. 188. Norris, R.V.] and the enormous quantities issued have also been referred to [see Vol. 5, No. 1, pp. 66 and 68].

Reference is made to the literature dealing with this subject. It appears that no accurate data have hitherto been published, and in the light of recent experiments in the production of other anti-sera it also appears that the interval between the last injection with virus and the first bleeding has been unnecessarily long. As the result of a series of observations made by Holmes the most recent method employed at the laboratory consisted in bleeding at 15 and 17 days' intervals after injection, at the rate of 6 and 8 cc. per pound body weight. The method investigated by the author consisted in bleeding each time at the rate of 6 cc. per pound of body weight at 8, 12 and 16 days after the injection of virus.

In the manufacture of anti-serum both hill bulls and plains buffaloes are employed. The latter animals are much less susceptible to rinderpest than hill bulls, but they were introduced by Holmes for the manufacture of serum as the supply of hill bulls is strictly limited. Hill bulls are, however, necessary for the production of virulent blood for inoculation and for routine serum testing.

In the first experiment 10 hyper-immune serum-making hill bulls were selected and divided into two lots; after inoculation with virulent blood these were bled at the two different series of intervals described above. The yields of serum per pound body weight were noted at each bleeding for each animal. The mixed sera obtained at each bleeding were then tested on susceptible hill bulls which were simultaneously inoculated with 0·5 cc. of virulent blood. In each test six animals were employed and were divided into three lots, the doses injected in the successive lots being 27, 54 and 81 cc. of serum per 600 lb. body weight. In addition two control animals were inoculated with virulent blood only in each test, and bled to death for virulent blood at the height of the attack.

From these tests it was found that:—

"(1) The rinderpest antibodies were present in the serum of hyper-immune animals in full amount eight days after the injection of virulent blood.

"(2) At the second bleeding on the 12th day the antibodies were still present in sufficient quantity for 27 cc. per 600 lb. body weight to protect hill bulls against the injection of virulent blood, which is equal to 1·5 cc. per 600 lb. in the case of plains animals.

"(3) The serum from a third bleeding four days later was still protective in doses of 54 cc. for hill bulls or 3 cc. for plains bulls per 600 lb. body weight.

"(4) The serum from a first bleeding 15 days after the injection of virulent blood was fully protective in doses of 27 cc. for hill bulls or 1·5 cc. for plains bulls, but at a second bleeding on the seventeenth day the potency had fallen so that 54 cc. per 600 lb. body weight were required to give full protection to hill bulls."

In the second experiment the value of the mixed serum obtained from three bleedings on the eighth, twelfth and sixteenth day after injection was compared with that of mixed serum from two bleedings taken on the fifteenth and seventeenth days. The procedure was the same as before. It was found that both lots of serum were protective in doses of 27 cc. for hill bulls or 1·5 cc. for plains animals per 600 lb. body weight, but that the "three bleedings" serum gave a distinctly better test.

In the third experiment the animals bled at the two series of intervals described above were inoculated with rinderpest virus at an interval of 12 days from the last bleeding; the two lots of animals were then bled as before and the mixed serum from each lot was compared. It was found that neither of the mixed sera in this experiment gave as good results as the sera of the second experiment. "The difference was, however, not sufficiently marked to draw any definite conclusions as to the greater production of anti-bodies having occurred in the animals previously bled three times than in those only bled twice."

In the fourth experiment it was decided to compare the "three bleedings" and "two bleedings" systems on a large scale, testing the two methods on hill bulls and buffaloes separately. 64 hill bulls and 18 buffaloes were thus employed in the first system and 103 hill bulls and 58 buffaloes in the second system. The yields of serum per pound body weight were noted as before and the mixed sera from each bleeding of hill bulls and of buffaloes were tested on susceptible hill bulls. The conclusions were as follows:—

"(1) The mixed sera obtained by both the 3-bleedings and 2-bleedings methods from hill bulls and buffaloes were protective in doses of 27 cc. for hill bulls or 1·5 cc. for plains animals per 600 lb. body weight; this is less than one-third of the standard dose issued.

"(2) The mixed sera obtained from hill bulls by the two methods were of about equal value according to the tests.

"(3) The mixed serum obtained from buffaloes by the 3-bleedings method was markedly stronger than that obtained by the 2-bleedings method and would probably protect in even smaller doses than 1·5 cc. per 600 lb. body weight in plains animals."

The author next gives a summary of the records of the body weights of the animals, the amounts of blood taken and yields of serum at each bleeding in experiments 2 and 3. A comparison of the figures for the "three bleedings" and "two bleedings" method in this observation showed :—

"(1) An increased yield of serum after each injection of 2·81 cc. per lb. body weight by the former method (9·6 cc.) as against the latter (6·79 cc.); this means a total increased yield of 41·4 per cent.

"(2) An increased percentage yield of serum from the blood taken of 5·3 per cent. by three bleedings (54·5 per cent.) over that from two bleedings (49·2 per cent.), the proportion of serum increasing with each successive bleeding of a series."

These results were confirmed by the yields of serum obtained in the experiment conducted on a large scale (Experiment 4).

[It appears that the author draws rather far-reaching conclusions from the results of titration experiments in which a comparatively small number of animals were used. The very small dose (1½ cc. per 600 lb. body weight) of serum calculated to be sufficient for immunising plains animals rather inclines one to think that a large proportion of these animals must possess a high degree of natural immunity towards rinderpest and that thus the small proportion of losses in an outbreak dealt with would not be altogether attributable to the use of the serum; this statement does not, however, minimise the value of the experiments performed with the object the author had in view.—ED.]

VON OSTERTAG (R.). **Ueber Rinderpest. Ein Beitrag zum Stande und zur Bekämpfung der Tierseuchen in Deutsch-Ostafrika.** [Rinderpest. A Contribution on the Incidence and Eradication of Animal Diseases in German East Africa.]—*Zeitschr. f. Infektionsk. parasit. Krankh. u. Hyg. der Haustiere.* 1916. Sept. Vol. 18. No. 1. pp. 1–48. (Continued from Vol. 17).*

(4) *Symptoms and post-mortem appearances.*—Under this heading, which covers half the present paper, Ostertag details at great length the appearances presented in rinderpest-affected animals in outbreaks in various districts. These were furnished in official reports in 1912 and 1913 by the Government Veterinary Surgeons (MANLEITNER, LICHTENHELD, MÜNCHGESANG and WÖLFEL), and they are also largely the result of the author's own observations. Although they contain nothing really new, the conclusions arrived at from this careful study are reproduced as follows :—

"The results obtained by me show how varied might be the clinical picture in different animals of the rinderpest raging at that time in German East Africa, and confirm the truth expressed by one of the first workers on rinderpest, Lorinser, that 'the totality of the symptoms appertaining to rinderpest can never be established in a single affected animal and scarcely in an affected herd, but is always more complete the greater the number of sick animals examined'; Gerlach further adds that neither in one affected animal nor in one affected herd, but only in several herds of different breeds in different outbreaks, countries, and seasons, can the totality of the symptoms and the variations in the progress of the disease be investigated. However, as symptoms of the disease in living animals which must always create a suspicion of rinderpest in one animal my observations point out the following :—

"The simultaneous existence of lachrymation and diarrhoea with a high degree of fever at the commencement and a normal or subnormal temperature towards the end of the disease. The suspicion is

* The publication containing the first part of this article has not yet been received, but an extract of it will appear when it is obtainable.

strengthened by the appearance of diphtheritic patches and ulcers on the mucous membrane of the mouth and of reddish streaks on the mucous membrane of the posterior extremity of the alimentary tract. In dead or slaughtered animals the suspicion of rinderpest is aroused by the presence of croupous deposits on, or a diphtheritic inflammation of, the mucous membrane of the mouth and of the fourth stomach, of the solitary follicles or Peyer's patches, or other parts of the intestinal mucous membrane; reddish streaks on the rectum or colon, enlargement of the gall bladder, and a thickened condition of the gall, and all these changes without any specific lesions of the spleen and of the kidneys.

"The changes of the gall bladder and gall appear both in rinderpest in German East Africa as well as in European rinderpest—which was designated centuries ago as 'Great Gall' (Grossgalle) owing to the most striking lesion in the gall bladder—to be the most constant sign of the disease. All other changes may vary but one can nevertheless by sufficient observation of the mucous membranes of the digestive tract in one or other locality (mouth, fourth stomach, small or large intestine) discover one or more of the specific lesions of rinderpest; here one must have in mind that in East Coast fever similar ulcers may be found on the mucous membrane of the fourth stomach as in the case of rinderpest.

"The results of post-mortem examination will thus, taken in conjunction with the symptoms observed during life (lachrymation, diarrhoea, and at the beginning a high morning temperature), regularly enable one to make a certain diagnosis even in a single case, the correctness of which can be confirmed without any doubt by the further course of the disease in an outbreak. A negative blood examination gives further support in a single case, but a positive result (showing piroplasms, trypanosomes) on the other hand gives no ground to exclude the possibility of the disease, for the piroplasm and trypanosome infection may be an accidental complication. This latter statement must be laid stress on for on the strength of a positive result obtained by the examination of one blood film forwarded for examination wrong action might be taken if one overlooked the possibility of the existence of rinderpest and if one neglected the further examination of the affected herd."

(5) *Transmission of rinderpest to other domesticated animals, especially sheep and goats.*—In the European outbreaks which occurred over 60 years ago great losses were observable amongst sheep and goats which had been in contact with rinderpest-affected cattle. Great losses also occurred among them in Egypt at that period. GERLACH, however (1865), denied that serious losses could be caused in sheep and goats although a fever and slight symptoms could be set up by means of artificial inoculation. In German East Africa no disease appeared in sheep and goats in the course of the epizootic studied by the author and according to the natives none died in the outbreak of rinderpest which occurred in 1892, and this circumstance saved the Masai from starvation after their cattle had been destroyed.

Reference is also made to the experiments of KOCH on the inoculability of the virus to sheep and goats and to his suggested use of the sheep as a medium for transporting rinderpest virus. Ostertag, however, states that the facts established by KOCH in 1896 with regard to South African sheep and goats did not apply to German East African sheep, as the rinderpest with which KOCH experimented was of a different character from that of German East Africa. Experiments carried out by Ostertag's assistants gave negative results as far as visible symptoms were concerned.

The solution of the question as to whether East African sheep or goats could be used for eliminating piroplasms infective for bovines from the rinderpest virus would be of great practical importance and moreover blood obtained from rinderpest-affected cattle loses its virulence in a comparatively short time (50 hours) and thus cannot be carried *in vitro* over long distances. Sheep and goats are in addition more easily transported and run less risk of spreading the infection during transit.

Tests made in Mpapua showed that the rinderpest virus could be carried in sheep and goats without weakening the virus and this made it possible to obtain a reliable virus for inoculation when severely affected cattle from which virus could be obtained were not available.

(6) *Eradication of rinderpest.*—Immediately on the receipt of reports from MANLEITNER and WÖLFEL that rinderpest had broken out the Government of German East Africa took steps to suppress the disease. The infected districts were isolated and the export of samli (animal fat) and hides was only allowed on condition that the samli was heated to at least 60° C. and the skins were thoroughly dried in the sun. Twelve thousand doses of serum from Cairo were at hand and a further 15,000 doses were obtained from Kabete, British East Africa. All proved effective. Two Institutes for the manufacture of anti-rinderpest serum were set up, one at Engare-Nanyuki and another at Mpapua.

The establishment at Engare-Nanyuki erected by WÖLFEL is described at some length. This station was placed in a forest and native reserve on the east side of the Meru Mountains about 5,000 ft. high, and about 2,500 acres in extent. It was bounded on the east by the deep Engare-Nanyuki River and on the other sides it was surrounded by forest and mountains in which leopards and hyaenas abounded. The spread of infection by the breaking out of infected animals was thus prevented on all sides. In the neighbourhood of the station the game was killed off and the station itself was divided by ditches into different parts, the northern ones being used as pasture and quarantine land. Cattle on arrival were passed successively through two kraals. In the first the blood was examined microscopically and the unaffected animals were then driven to the second kraal and washed with Cooper's dip. They were then put into the quarantine enclosure. A description is then given of the laboratory installations and animal sheds, etc. Seventy-two serum cattle were kept at the place during Ostertag's stay.

The method of immunisation was as follows:—Two strains of rinderpest virus were employed. An initial immunity was produced by means of the ordinary double inoculation, the dose of serum being small so as to obtain a powerful reaction. After four weeks' rest the animals each received 1,000 cc. of virulent blood and after a further two weeks 3,000 cc., injected subcutaneously over the whole body in quantities of 100 cc. After the disappearance of the reaction—about 14 days after the second hyper-immunisation—the first blood extraction period commenced and this consisted of six extractions, each of 3½ to 4½ litres according to the size of the animal, taken at intervals of four days. The animals were then given three weeks' rest and again inoculated with 3,000 cc. of virulent blood to be ready again in another three weeks time for a further blood extraction. This was repeated until the animals were no longer fit for serum production.

The virus was obtained from young heifers and calves which had been inoculated with from 5 to 10 cc. of virulent blood. The animals showed a rise of temperature in within three to five days after the infection and after seven to eight days the first symptoms of disease appeared. By means of blood and gland examination repeated daily during this period other diseases were eliminated and especially those due to *P. bigeminum*, *P. mutans*, and *Anaplasma marginale*. Three days after the commencing rise of temperature 3 to 5 litres (calves 1 litre) of blood were extracted and on the fourth day a similar quantity. If the animal was very much exhausted it was bled to death from the carotid. Animals which bore repeated blood extraction were only completely bled on the tenth day.

A month's collection of serum was titrated at the same time by injecting a series of cattle with 10, 20, 30, and 40 cc., respectively, of serum together with virus and the control animal with virus only. The serum was mixed with ½ per cent. carbolic acid and distributed in 250 cc. bottles. At this place 67,000 doses of serum were manufactured between January and August, 1913. The average dose consisted of 25 cc. of serum for a medium sized animal when used for the double inoculation.

As there are still districts, viz., the Urundi and Ruanda districts, which are free of rinderpest an endeavour was made to keep a large reserve of serum to cope with the possibility of outbreaks of rinderpest occurring in these districts.

The establishment of a second serum station was attended with some difficulties owing to the lack of suitable sites, but it was finally established in Mpapua and it commenced delivering serum in July, 1913. Wölfel was again sent to this station to superintend the manufacture of serum and also with the assistance of a trained staff to investigate some important problems, which are then detailed by the author, in connection with rinderpest.

Before the manufacture of serum had attained sufficient dimensions the ordinary prophylactic measures were adopted, consisting in prohibition of movement, destruction of dead bodies, and isolation of affected animals. Dung was removed from the isolation kraals but this was not possible everywhere as some of the natives (the Tagago) use these for burying their dead. Great difficulties were encountered in carrying out the policy of isolation. The flesh of the diseased cattle was allowed to be eaten provided it was well cooked, but the transport of raw flesh was forbidden on account of the danger of spreading the infection.

Koch's gall immunisation was also attempted on a fairly large scale. Though not very satisfactory it was found to be capable of giving fairly good results provided the gall was taken when fresh and from an animal which died seven or eight days after the commencement of the illness or was killed just before death. The immunity was prolonged if inoculation with virulent blood was performed 10 days after the gall inoculation. The production of abscesses at the point of inoculation gained disfavour for this method in the eyes of the natives. 10 cc. of gall was found necessary for immunising one bovine and as the gall bladder contains 500 cc. of gall a sick animal can furnish material sufficient to immunise 50 sick animals. The losses in the Bahi district amounted to 10 per cent and in Bugiri to 25 per cent. with this method.

The only means for the suppression and eradication of rinderpest in a country like German East Africa according to Ostertag is the simultaneous method, that is to say, inoculation with specific serum and virulent blood.

The objections raised against this method especially by the Bloemfontein Rinderpest Conference are referred to and on the other hand the short period of immunity conferred by serum alone, as shown by WARD's experiments in the Philippines, etc., is pointed out.

The experiments carried out at the Veterinary College in German East Africa demonstrated the superiority of this method. In East Africa the introduction of piroplasmosis with the virus was found to be unimportant; as nearly all the cattle are infected with these organisms they have all become immune. Also, rinderpest usually occurs in districts where the tsetse fly is unknown or seldom found and, moreover, the natives are very careful in guarding their cattle against the tsetse fly. The results of the simultaneous inoculation in German East Africa fulfilled all expectations. Failure only took place in two instances, viz., when an imported untitrated serum was issued and secondly when an infected serum was used. The losses as a rule amounted to only 1 per cent.

Instances are then given of outbreaks in which the beneficial results were easily observable. In the case of some animals transported to the coast for slaughter inoculation with serum alone was performed. As this transport in some cases took about six weeks or more Ostertag considers that the protection afforded was very doubtful.

Ostertag's conclusions are as follows:—

"(1) In all affected centres all animals from a milch calf up to an adult ox must be thoroughly inoculated in order to ensure safety. If this is not done dangerous rinderpest centres are created with regular sickening of the growing young cattle. The healthy animals must be treated by the simultaneous method and the affected ones with serum alone in double doses. If sufficient serum is not available gall inoculation can be resorted to with the above-described precautions. When inoculation is carried out in this way the insufficiently immunised animals die while the remainder are proof against rinderpest. Six weeks after the stamping out of the disease and after all dung has been burned the animals can be safely transported.

"(2) In addition to the diseased herds those in the neighbourhood should be inoculated and treated in the same way as animals in the affected districts. Calves may be inoculated with pure virus. As soon as sufficient serum is available the susceptible herds must be inoculated with serum only to prevent the spread of the disease.

"(3) For the safety of cattle in the settlers districts on the Meru and Kilimandjaro the entire herds should be innoculated.

In order to safeguard the supply of meat to the coast the same should be done to all cattle in the market districts.

"(4) If adequate serum is available all cattle on farms lying apart should be gradually inoculated to prevent a fresh outbreak. I also proposed that all skins should be sent to the nearest Government Station and there inspected by an official as to their complete dryness.

"If this is done the complete stamping out of the disease in German East Africa may be looked forward to."

Ostertag further recommended the inoculation of all cattle on the northern frontier owing to the danger of importing the disease from the large native reserves in British East Africa. The danger from British East Africa should be guarded against on account of the permanence of rinderpest in Abyssinia and Somaliland.

ZONCHELLO (A.). **Il gulhai nel Sahel.** [Rinderpest in Sahel.]—*Clinica Vet.* 1917. Mar. 15. Vol. 30. No. 5. pp. 113–132.

The Sahel district is a long strip of country bordering the Red Sea in the Italian colony of Eritrea. Although rinderpest was very prevalent in other parts of the colony the Sahel district appears to have been free of disease until the year 1914, when after the return of a herd, which had been taken out of the district into the neighbourhood of an affected centre, in the rainy season rinderpest appeared and immediately caused a serious outbreak throughout Sahel. The mortality rose up to over 95 per cent. of the total head of cattle and caused great misery among the entirely pastoral population. Recourse was then made to a large extent to raising sheep and goats or to mixed flocks. In the following year rinderpest broke out afresh, and the disease has since become enzootic. The mortality, however, progressively decreased until it did not, except in rare instances, exceed 50 per cent. In rare cases the mortality was nil.

Rinderpest appears to have been first imported into Eritrea in 1887, and caused great havoc at the time. Its spread was occasioned, according to the author, through the incompetence and dilatoriness of the authorities in the administration of elementary prophylactic measures; instead, specific measures of treatment were attempted on a large scale, with, upon the whole, rather unsatisfactory results. In 1903 it was thus decided to adopt the simultaneous method, or KOLLE & TURNER's method, just at the time when THEILER and the Bloemfontein Conference condemned it.

From inquiry among the natives the author then details the history of attempts at sero-vaccination in eight different outbreaks in Sahel from 1905 up to the time of his arrival (1914). In many instances, however, it appeared that although the results were quite satisfactory in the case of the animals treated the method created new centres of disease and a considerable spread from the original centre. The failure to get better results, however, judging from the figures presented by the author, appears to the reader to be due not to defects in the method, but to its not being rigorously or rationally carried out.

The British authorities in the Soudan protested against its use on the Anglo-Italian frontier in the winter 1914–1915 as the Italians were accused of maintaining the virus and distributing it.

The method adopted by the author on his arrival, after a study of the disease, was to proceed simply by strict isolation of existing centres. The results obtained in less than a year were considered to be most satisfactory and it is believed that if this plan was adopted throughout the colony and a close watch kept on the Abyssinian frontier rinderpest would soon be caused to disappear almost entirely. This method seems also to be more in favour among the natives, who soon learn to recognise its advantages.

It is believed that wild animals are susceptible to rinderpest and sero-vaccination should be particularly forbidden where these exist. The affected wild animals are said to isolate themselves from other animals. According to wide enquiry among the natives goats do not naturally contract rinderpest in this district, and, moreover, they believe that cattle, such as transport cattle living among herds of goats, do not contract the disease in the scene of an outbreak. The author quotes an observation of his own which corroborates the view of the natives.

Unnecessary delay is caused in treating a herd by inoculation. It is held by many people in the district that the Serum Institute at Asmara prevents the disease from being finally extinguished in the colony. The cost of sero-vaccination, moreover, amounts to about 25 per cent. of the value of the inoculated animals.

(c) Nairobi Sheep Disease.

Montgomery (Eustace). **On a Tick-borne Gastro-Enteritis of Sheep and Goats occurring in British East Africa.**—*Jl. Comp. Path. and Therap.* 1917. Mar. Vol. 30. Pt. 1. pp. 28–57. With 6 charts.

A brief reference to this condition was made in the Annual Report of the Veterinary Bacteriologist for East Africa for the year 1914-1915 [see this *Bulletin*, Vol. 5, No. 1, p. 66]; the experiments upon which the conclusions were based are detailed in this paper.

Field observations. The disease was first brought under the author's notice in 1910 when heavy mortality was observed among the large numbers of sheep brought by traders from various outlying areas into the Nairobi district. The epizootiology of the disease up to 1915 is then briefly discussed. It is considered that the disease affects essentially the Kikuyu country, which extends from Mount Kenia to Nairobi. No immunity was ever discoverable in sheep in the outlying districts, such as the Masai Reserve, from which sheep were usually imported, and these districts are probably free from infection; the brown tick, *Rhipicephalus appendiculatus*, is remarkably rare in these districts and this probably accounts for their freedom from this disease and East Coast fever.

The mortality among native sheep in naturally occurring outbreaks appears to be very high; in the first observed outbreak 2,000 sheep died out of 3,000 within one month of arrival in the infected area.

The symptoms are briefly those of dulness to commence with, followed shortly afterwards by severe diarrhoea and abdominal pain. Death usually occurs within two days after the onset of symptoms. The temperature is normal while visible symptoms are exhibited, but a characteristic curve is manifested for a day or two before these are observed.

On post-mortem examination one notices evidence of diarrhoea, often a blood-stained discharge from the nostrils, and on examination of the internal organs one finds an acute, often haemorrhagic, inflammation of the mucous membrane of the fourth stomach and of the intestines, splenic enlargement, distension of the gall bladder, and congestion of the trachea.

Laboratory observations. When susceptible sheep have been inoculated with virulent blood a sudden rise of temperature up to 105° or 106° F. is usually observed within 48 hours. This remains high—between 105° and 108° F.—and then falls suddenly to normal, where it remains for one or two days before death or recovery takes place.

There appears to be some difference in the virulence of various strains, the minimum period between inoculation and the initial rise of temperature varying from 36 to 84 hours. Prior to death the temperature may be subnormal. Death usually occurs between four and eight days after inoculation—average 148 hours.

Following infection with ticks the incubation period averaged 9·4 days—minimum 5 and maximum 16—and the reaction 3·6 days.

No visible symptoms could be noted until about the last day of the reaction when symptoms set in as in the natural cases commencing with dulness, loss of appetite, diarhoea, mucous discharge from the nostrils, etc. In the rare cases of recovery the symptoms were usually limited to those of dulness, inertia, and slight anaemia. The onset of diarrhoea appears invariably to indicate a fatal termination. Out of a total of 224 sheep inoculated 3 only failed to react and 130 died. The mortality was much heavier among native sheep (71·5 per cent.) than in half-bred (31·5 per cent.), or in Merino sheep (30·7 per cent).

The post-mortem appearances of animals dead from natural infection from experimental infection with ticks or by inoculation are very constant; these are described in detail by the author.

Sheep and goats appear to be the only animals susceptible. Out of 20 goats, mostly half-bred Angora, one only proved to be immune on inoculation; three gave no temperature reaction but the virus was shown to exist in two of these by sub-inoculation; five gave a very slight temperature reaction but showed no symptoms. The blood, however, was shown to be virulent on inoculation. The remaining 11 goats reacted as in the case of the sheep, but the onset of the disease was delayed by about a day and the symptoms were much milder. A transitory diarrhoea was noted in five only. Two goats died of gastro-enteritis, one on the 6th day and one on the 11th day.

Attempts were made to infect cattle, buffalo, horses, mules, donkeys, and other animals, but negative results only were obtained and their blood was found to be avirulent on sub-inoculation, with one exception in which the blood of an ox was found to be infective 24 hours after intravenous inoculation of a large dose of virus.

Experiments to determine the virulence of the various body fluids and tissues showed that the blood was always virulent when taken during the thermal reaction. It was found that the virus was not destroyed by short contact with equal parts of oxalate-carbol-glycerine solution (oxalate of potash 5 grammes, carbolic acid 5 grammes, glycerine 1,000 c.c. and water 1,000 c.c.). The virus was found to be present in the blood for about one day subsequent to the return to normal temperature. Serum obtained from blood during the infective period was proved to be virulent both on direct inoculation and after filtration. Saline extracts of organs removed from animals dying with the acute reaction were virulent. When the temperature had been normal for some days and the clinical symptoms were present, negative results were frequently obtained. The pericardial fluid obtained from a sheep dead from the acute form of the disease was infective.

The bile gave negative results.

Urine obtained from the bladder of a sheep after death was found to be infective when given in a dose of 10 c.c. subcutaneously. Urine obtained during life at the height of a reaction gave positive results in two cases on inoculation while six experiments were negative, but in two of the latter cases the urine was administered *per os*.

Out of five sheep drenched with faeces obtained after death from animals dead of the disease three did not react while the remaining two died on the 7th and 18th days, respectively, without manifesting any temperature reaction and subinoculations made from one were negative. A watery decoction of faeces passed through a Berkefeld filter failed to infect on subcutaneous inoculation.

A study of the various methods of experimental infection showed that the disease could be regularly and constantly transmitted by subcutaneous inoculation as well as by intravenous and intraperitoneal inoculation. The disease was also readily transmitted by intracutaneous inoculation performed by applying a drop of citrated virulent blood to the shaved and lightly scarified ears of two sheep. The minimum lethal dose of serum was shown to be as low as 0·001 c.c. in one test.

When administered *per os* virulent blood was found to be infective in three cases in doses of 50 c.c. Ten c.c., however, failed to produce a reaction. Two sheep fed with dry lucerne over which 100 c.c. had been sprinkled reacted and died. Another sheep fed with grass over which 50 c.c. of urine obtained after death had been sprinkled remained unaffected. The same sheep when fed with grass over which 50 c.c. of virulent blood had been sprinkled also remained healthy, but when later fed with grass on which 50 c.c. of virulent blood had been sprinkled a reaction occurred and death took place on the 9th day.

Experiments showed that it was not possible to transmit the disease by intimate contact in pens or in a small paddock. It was proved that the natural method of transmission was through the agency of ticks—*Rhipicephalus appendiculatus*—which had fed as nymphae on reacting sheep.

Bacteriology. Direct microscopic examination was negative and no organism was cultivable on ordinary media.

The filterability of the virus was demonstrated in numerous experiments, in which blood, in dilutions of from 1 to 4 up to 1 to 999 with saline solution or with tap water, was passed through a Berkefeld No. 7 and Chamberland F candles. The number of negative results formed a small minority and these were probably due to the use of occluded candles.

Experiments to ascertain the resistance of the virus showed that a recovered animal is not a reservoir for the virus. Blood taken from recovered animals whose temperature had been normal for from 7 to 10 days failed to infect even in large doses. The resistance of the virus *in vitro* was found to be comparatively long. Sterile serum or citrated blood was found to retain its virulence for about 28 days when exposed to the air as in plugged flasks, for up to 45 days when contained in sealed tubes or ampoules, and for about a week when mixed with equal parts of oxalate-carbol-glycerine solution.

Citrated blood kept at 37° C. in the incubator for 42 hours retained its virulence. When dried *in vacuo* at 37° C. for 72 hours the virulence had disappeared.

A temperature of 50° C. acting for one hour did not destroy the virus; exposure for two hours at this temperature produced partial destruction, the inoculated sheep developing only a temperature reaction and becoming immune to subsequent inoculation. Inoculation of a fairly large number of sheep with blood thus exposed for 1½ hours produced variable results; about a half developed a delayed reaction and died while nearly all the rest showed slight reactions and became immune.

A temperature of 60° C. acting for from 5 minutes to 1½ hours completely destroyed the virulence.

Mode of transmission. A number of experiments are detailed in which susceptible sheep were grazed over pastures believed to be contaminated by the infection, "and on every occasion one or more contracted the disease even if they were so muzzled as to prevent the animal from eating the grass or drinking the water of that infected area."

Sheep fed on grass cut from an infected area did not contract the disease, but it is remarked that the grass obtainable in these cases was procured from the longer growths occurring close to the village huts and neglected by sheep, and not the short turfy couch grass grazed over and harbouring ticks.

The rôle of ticks in the transmission of the disease was ascertained in the first place in a number of experiments with ticks obtained from naturally reacting sheep. A number of adult *Rhipicephalus appendiculatus* and a few adult *Amblyomma variegatum* emerged from the nymphae. Those obtained from all the other stages of ticks collected died prematurely. When applied to susceptible sheep *R. appendiculatus* was found invariably to transmit the infection while the other species of tick gave negative results.

Numerous experiments were also performed with laboratory-bred ticks. It was found impossible to convey the disease by means of larval *R. appendiculatus* born of mothers which had fed on reacting sheep. Likewise nymphae which were born of mothers feeding on sick animals and which did not convey the disease in the larval stage failed to convey the infection. Ticks which had fed as larvae on reacting sheep and failed to transmit the infection as nymphae also failed to convey the disease in the adult stage.

Experiments, however, showed that ticks which had fed as nymphae on reacting sheep in most cases transmit the disease as adults. The blood of animals thus infected was found to be virulent on sub-inoculation.

Immunity. An animal which has recovered from the natural or the experimental disease does not react to a second infection and tests indicated that the duration of this immunity may extend for several years. Half-bred and pure-bred sheep appear to be much more resistent to infection than native sheep. Owing to the peculiar conditions of grazing adopted by the natives the disease appears to be very localised even in infected areas.

Artificial immunisation yielded by no means promising results. Attempts were made to prepare an anti-serum by inoculating immune sheep subcutaneously, intra-peritoneally and intramuscularly with citrated virulent blood in doses up to 500 c.c. This dose could be given as a second injection. After a number of injections the animals were bled in about a fortnight after the last injection and a further maximum injection was made if necessary.

"The sera obtained from each animal, or from a series of animals, after each hyperimmunising were kept separate and used in independent tests, either alone or in association with virus given simultaneously or at variable intervals later.

"No clearly satisfactory results were obtained. It appeared that when sheep were strongly hyperimmunised the sera acquired haemolytic properties and killed a higher proportion of animals than it saved; and if fortification was not intense it possessed little or no prophylactic powers.

"As the object of this work was to devise measures which would safeguard the sheep-owner should the disease gain entrance to his flocks, it became apparent that serum prophylaxis, entailing the manufacture of expensive serum, would not be a practicable method except in extreme cases. Further, additional research indicated that the disease did not exist in the districts wherein sheep farming was extensively carried on, and as this line of preventive treatment could not yet be applied to the native Reserves the enquiry was suspended."

A study of the phenomena of haemolysis in sheep inoculated with the serum, together with details of results obtained, next follow.

A small number of experiments indicated that a quite appreciable attenuation of the virus is effected by passage through goats, and that the results appear to justify observation on a more extended scale.

Prevention. Movement of affected flocks should be prohibited, but this is difficult to effect in practice.

"Individual owners of land where *Rhipicephalus appendiculatus* exists should not permit the entry of doubtful sheep until they have undergone a quarantine of at least 21 days without any deaths occurring from this disease. The sheep might then be introduced. Should deaths occur, the quarantine area grazed over must be regarded as infected; and, though the sheep can then be moved without fear, it should be destocked of sheep and goats for eighteen months, and grazed with cattle only for that period."

A small experiment indicated that the dipping of sheep at three-day intervals might be considered beneficial.

"The eradication of ticks capable of carrying the disease should form the basis of preventive measures.

"*Rhipicephalus appendiculatus* is also the carrier of East Coast fever in cattle, and for its eradication cattle must be dipped every three days.

"There is no doubt that dipping cattle at a three-day interval will very greatly clear the ground of all ticks, and in their absence gastro-enteritis of sheep cannot spread."

(d) Variola.

Gauducheau (A.). **Recherches sur la variole-vaccine.** [Investigations on Variola-Vaccinia.]—*Bull. Soc. Path. Exot.* 1917. Mar. Vol. 10. No. 3. pp. 260–268.

In this memoir the author presents the results of experiments, made during the course of the last ten years at the Vaccine Institute, Tonkin (French Indo-China), on the relationships between variola and vaccinia.

The following are his conclusions:—

"(1). There exists no symptom by which one can absolutely and constantly differentiate between variola and vaccinia.

"(2). Variola immunises against vaccinia and vice versa.

"(3). A few attempts at the transformation of variola into vaccinia have given positive results.

"(4). The differences which exist between the two states of the virus appear to be solely in the degree of adaptation to the susceptible species and constitute two varieties or types of the same virus: the human type or variola and the bovine type or vaccinia."

MISCELLANEOUS.

VAN SACEGHEM (R.). **Etude de tumeurs constatées sur une génisse de la race zebu.** [Tumours in a Heifer of the Zebu Breed.]—*Bull. Soc. Path. Exot.* 1917. Mar. Vol. 10. No. 3. pp. 182–183.

A zebu heifer kept at Zambi showed over a period of two years a large number of warty growths around the anus. These growths spread around the vulva and over the tail and then affected the teats, limbs, and the right auditory meatus. The last-named localisation brought about the death of the animal. The tumours were found to be contagious for the animal itself. The warts were composed of a fibrous base covered with a cluster of small, very fragile, reddish, transparent papillomata from 5 mm. to 1 cm. in length by a few mm. in breadth.

These papillomata are often found as complications of tropical dermatitis in bovines [see above, extract p. 108].

A description is given of the histology of the lesions.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 5, No. 1, pp. 77–84.]

PROTOZOAN PARASITES.

ALEXEIEFF (A.). Mitochondries et corps parabasal chez les Flagellés. [Mitochondria and Parabasal Bodies in Flagellates.]—*C.R. Soc. Biol.*, 1917. Mar. 31. Vol. 80. No. 7. pp. 358–361. With 1 fig.

——. Mitochondries et rôle morphogène du noyau. [Mitochondria and Morphogenetic Rôle of the Nucleus.]—*Ibid.* pp. 361–363.

BEHREND (Kurt). Zur Conjugation von Loxocephalus. [Copulation in Loxocephalus.]—*Arch. f. Protistenk.*, 1916. Aug. Vol. 37. No. 1. pp. 1–5. With 1 coloured plate.

BREUER (Rudolf). Fortpflanzung und biologische Erscheinungen einer *Chlamydophrys*-Form auf Agarkulturen. [The Growth and Biological Phenomena of a Chlamophrys Organism on Agar.]—*Arch. f. Protistenk.*, 1916. Aug. Vol. 37. No. 1. pp. 65–92. With 2 text figs. & 1 plate.

COMADON (J.). Phagocytose in vitro des Hématozoaires du Calfat (enrégistrement cinematographique). [Phagocytosis *in vitro* of the Haematozoa of the Java Sparrow. (Cinematographic representation.]—*C.R. Soc. Biol.*, 1917. Mar. 17. Vol. 80. No. 6. pp. 314–316. With 1 plate comprising 2 figs.

LÉGER (L.) & DUBOSCQ (O.). Sporozoaires de *Glossobalanus minutus* Kow. *Eimeria epidermica* n. sp.; *Eimeria beauchampi* n. sp.; *Selenidium metchnikovi* n. sp.—*Ann. Inst. Pasteur*, 1917. Feb. Vol. 31. No. 2. pp. 60–72. With 3 plates.

—— & HESSE (E.). Sur les Microsporidies de la crevette d'eau douce. [The Microsporidia of the Fresh-Water Prawn.]—*C.R. Soc. Biol.*, 1917. Jan. 6. Vol. 80. No. 1. pp. 12–15. With 6 figs.

—— & HOLLANDE (A. C.). Sur un nouveau protiste à facies de *Chytridiopsis*, parasite des ovules de l'huître. [A New Protozoon resembling Chytridiopsis, a Parasite of the Ovules of the Oyster.]—*C.R. Soc. Biol.*, 1917. Jan. 20. Vol. 80. No. 2. pp. 61–64. With 4 text figs.

KEILIN (D.). Une nouvelle entamibe, *Entamoeba mesnili* n. sp., parasite intestinal d'une larve d'un diptère. [A New Entamoeba, *E. m.*, an Intestinal Parasite of a Dipterous Larva.]—*C.R. Soc. Biol.*, 1917. Feb. 3. Vol. 80. No. 3. pp. 133–136. With 25 figs.

PASCHER (A.). Rhizopodialnetze als Fangvorrichtung bei einer plasmodialen Chrysomonade. [Trap Apparatus in the Form of Rhizopodial Threads in a Plasmodial Chrysomonad.]—*Arch. f. Protistenk.*, 1916. Aug. Vol. 37. No. 1. pp. 15–30. With 6 text figs. & 1 coloured plate.

——. Fusionsplasmodien bei Flagellaten und ihre Bedeutung für die Ableitung der Rhizopoden von den Flagellaten. [Fusion Plasmodia in Flagellates and their Significance regarding the Origin of Rhizopoda in Flagellates.]—*Ibid.* pp. 31–64. With 20 text figs. & 1 coloured plate.

POCHE (Franz). Die Verwandtschaftsbeziehungen der vermeintlichen Gregarine *Microtaeniella clymenellae* Calk. [Relationships of the supposed Gregarine *M. c.*]—*Arch. f. Protistenk.*, 1916. Aug. Vol. 37. No. 1. pp. 6–14.

SANGIORGI (Giuseppe). Sulla cultura in vitro degli spironemi dell' intestino umano. [Cultivation in vitro of Spirochaetes from the Human Intestine.]—*Pathologica*, 1917. Feb. 15. Vol. 9. No. 198. pp. 61–62.

SHORTT (H. E.). Notes on Two Haemogregarines of Cold-Blooded Vertebrates.—*Indian Jl. Med. Res.*, 1917. Jan. Vol. 4. No. 3. pp. 402–413. With 2 coloured plates.

SWELLENGREBEL (N. H.) & SCHIESS (J. R.). Quelques remarques sur la morphologie de l' *Entamoeba histolytica* et la valeur diagnostique de l'infection rectale des chats. [Some Remarks on the Morphology of *E.h.* and the Diagnostic Value of Rectal Inoculation of Cats.]—*Bull. Soc. Path. Exot.*, 1917. Jan. Vol. 10. No. 1. pp. 13–17. With 4 text figs.

WATSON (Minnie E.). Observations on Polycystid Gregarines from Arthropoda.—*Jl. Parasit.*, 1916. Dec. Vol. 3. No. 2. pp. 65–75. With 1 plate.

METAZOAN PARASITES.

Arthropods (Acari, Flies, Ticks).

BURKHARDT (F.). Die Larve des Speckkäfers (*Dermestes lardarius*, L.), ein Feind des schlüpfenden Geflügels. [The Larva of the Bacon Beetle, an Enemy of Hatching Poultry.]—*Berlin. Tier. Woch.*, 1917. Jan. 25. Vol. 33. No. 4. pp. 44–45.

CARPANO (M.). Sulla diagnosi clinica e microscopica delle piu frequenti dermatosi parassitarie degli equini. [Clinical and Microscopic Diagnoses of the more Common Skin Affections in the Horse.]—*Moderno Zooiatro*, 1916. Nov. 30 & Dec. 31, & 1917, Jan. 31. Vol. 5 & 6. Nos. 11, 12 & 1 respectively. pp. 261–277, 289–302, & 7–17. With 13 figs.

HADWEN (S.). A further Contribution on the Biology of *Hypoderma Lineatum*.—*Canada Dept. of Agric. Health of Animals Branch. Scientific Series.—Bull.* No. 21. 1916. Ottawa: Govt. Printing Bureau.

——. Warble Flies. The Economic Aspect and a Contribution on the Biology.—*Canada Dept. of Agric. Health of Animals Branch.—Bull.* No. 16. 1912. Nov. 25.

—— & BRUCE (E. A.). Observations on the Migration of Warble Larvae through the Tissues.—*Canada Dept. of Agric. Health of Animals Branch, Scientific Series.—Bull.* No. 22. Ottawa: Govt. Printing Bureau, 1916.

HENRY. Otacariases et prophylaxie des gales psoroptiques. [Otacariases and Prophylaxis of Psoroptic Mange.]—*Bull. Soc. Cent. Méd. Vét.*, 1917. Jan. 4.—*Rec. Méd. Vét.*, 1917. Jan. 30–Feb. 28. Vol. 92. Nos. 3 & 4. pp. 41–48.

HOWARD (L. O.). Report of the Entomologist.—*U.S. Dept. Agric., Bur. of Entom., Washington, D.C.*, 1916. Aug. 24. pp. 8–11.

v. KEMNITZ (G. A.). Untersuchungen über den Stoffbestand und Stoffwechsel der Larven von *Gastrophilus equi* (Clark), nebst Bemerkungen über den Stoffbestand der Larven von *Chironomus* (spec ?) L. (Physiologischer Teil). [Investigations on the Nature of and Changes in the Composition of the Larva of *Gastrophilus equi* with Remarks on the Nature of the Larva of *Chironomus* sp.]—*Zeitschr. f. Biologie*, 1916. Dec. 16. Vol. 67. Nos. 3, 4 & 5. pp. 129–244. With 2 plates and 5 text figs.

MITZMAIN (M. B.). A Digest of the Insect Transmission of Disease in the Orient with Especial Reference to the Experimental Conveyance of *Trypanosoma evansi*.—*New Orleans Med. & Surg. Jl.*, 1916. Dec. Vol. 69. No. 6. pp. 416–424.

[This is for the most part a résumé of a previous paper that was pretty fully extracted in the preceding number of this *Bulletin*.]

QUIROS (D.). Biologia de la Nigua [Biology of the Chigger.]—*Anales Hosp. de San José*, 1916. Nov. 1. Vol. 2. No. 1. pp. 1–17. With 4 figs.

SWEET (Georgina) & SEDDON (H. R.). The Viability of *Melophagus ovinus*, Linn., the Sheep Louse-Fly, Sheep Ked, or Sheep "Tick." *Vet. Jl.*, 1917. Apr. Vol. 73. No. 4. Australian Supplement. pp. 6–14. With 3 tables.

TAYLOR (Frank H.). *Sarcophaga froggatti*, sp. n. A New Sheep-Maggot Fly.—*Bull. Entom. Res.*, 1917. Jan. Vol. 7. No. 3. p. 265.

DU TOIT. Ueber das Sammeln und die Zucht unserer heimischen Zecke *Ixodes ricinus* L. [Collection and Breeding of the German Tick *I.r.*]—*Berlin. Tier. Woch.*, 1917. Mar. 8 & 15. Vol. 33. Nos. 10 & 11. pp. 109–112 & 124–127. With 4 figs.

WEIDMAN (F. D.). *Cytoleichus penrosei*, a New Arachnoid Parasite found in the Diseased Lungs of a Prairie Dog, *Cynomys ludovicianus*.—*Jl. Parasit.*, 1916. Dec. Vol. 3. No. 2. pp. 82–89. With 2 plates.

WATERSTON (James). Notes on the Morphology of Chalcidoidea bred from Calliphora.—*Parasitology*, 1917. Feb. Vol. 9. No. 2. pp. 190–198. With 2 text figs.

VAN ZWALUWENBURG (R. H.). Report of the Entomologist.—*Rept. Porto Rico Agric. Expt. Sta.*, 1915. 1916. Nov. 23. Washington D.C. p. 42.

["The cattle tick (*Margaropus annulatus australis*) is being studied with a view to working out a method of extermination by pasture rotation applicable to Porto Rico. This tick is undoubtedly a most serious drain on the island's prosperity, but it is hoped that its ultimate extermination is possible."—*Rev. App. Entom.* Series B. 1917. Apr. Vol. 5. Part 4. p. 64.]

Helminths.

BAUER. Untersuchungen über Sommerwunden. [Researches on Summer Sores.]—*Zeitsch. f. Veterinärk*, 1917. No. 1. p. 1. (Extracted in *Berlin. Tier. Woch.*, 1917. Mar. 1. Vol. 33. No. 9. p. 103).

BOULENGER (Charles L.). Sclerostome Parasites of the Horse in England. II. New Species of the Genus *Cylichnostomum*.—*Parasitology*. 1917. Feb. Vol. 9. No. 2. pp. 203–212. With 5 text figs.

CIUREA (J.). Die Auffindung der Larven von *Opisthorchis felineus, Pseudamphistomum danubiense* und *Metorchis albidus* und die morphologische Entwicklung dieser Larven zu den geschlechtsreifen Würmern. [The Discovery of the Larvae of *O.f., P.d.,* and *M.a.* and the Morphological Development of these Larvae into Sexually Mature Worms.]—*Zeitschr. f. Infektionskr. Parasit. Krankh. u. Hyg. d. Haustiere*, 1917. Feb. 14. Vol. 18. No. 3. pp. 301–333 (to be continued). With 5 plates.

GALLI-VALERIO (B.). Parasitologische Untersuchungen und Beiträge zur parasitologischen Technik. [Researches in Parasitology and Studies in Technique.]—*Cent. f. Bakt.* 1. Abt. Orig., 1916. Dec. 19. Vol. 79. No. 1. pp. 41–48. With 6 figs.

LANE (Clayton). *Bunostomum kashinathi* and the Ancylostomidae.—*Indian Jl. Med. Res.*, 1917. Jan. Vol. 4. No. 3. pp. 413–439. With 4 plates comprising 21 figs.

ROMANOVITCH. Microfilaire hémorragique du cheval. [Haemorrhagic Microfilaria of the Horse.]—*C.R. Soc. Biol.*, 1916. July 29. Extracted in *Rec. Méd. Vét.*, 1917. Mar. 15. Vol. 93. No. 5. pp. 147–148.

SCHELLHASE. Vorläufige Mitteilung über das Vorkommen von Trematodenlarven im Wels von Deutsch-Ostafrika. [Preliminary Report on the Occurrence of Trematode Larvae in the Silurus of German East Africa.]—*Berlin. Tier. Woch.*, 1917. Feb. 8. Vol. 33. No. 6. pp. 69–70.

SEURAT (L. G.). Sur les affinités du genre *Maupasina* (*Heterakidae*). [Relationships of the Genus *Maupasina.*]—*C.R. Soc. Biol.*, 1917. Mar. 31. Vol. 80. No. 7. pp. 350–354. With 2 text figs.

——. Une nouvelle Filaire péritonéale des Rongeurs. [A New Peritoneal Filaria of Rodents.]—*Ibid.* pp. 354–357. With 3 text figs.

——. Physaloptères des Reptiles du Nord-Africain. [Physaloptera of North African Reptiles.]—*Ibid.* Jan. 6. No. 1. pp. 43–52. With 4 text figs.

SKRJABIN (K. S.). *Aprocta microanalis nov. sp.*, nouvelle filaire des yeux d'oiseaux. [*A. m.*, a New Filaria of Birds' Eyes.]—*C.R. Soc. Biol.*, 1917. Mar. 17. Vol. 80. No. 6. pp. 314–316. With 1 plate comprising 2 figs.

STEWART (F. H.). On the Development of *Ascaris lumbricoides* Lin. and *Ascaris suilla* Duj. in the Rat and Mouse.—*Parasitology*, 1917. Feb. Vol. 9. No. 2. pp. 213–227. With 9 text figs & 1 plate.

TYZZER (E. E.) & HONEIJ (J. A.). The Effects of Radiation on the Development of *Trichina spiralis* with Respect to its Application to the Treatment of other Parasitic Diseases.—*Jl. Parasit.* 1916. Dec. Vol. 3. No. 2. pp. 43–56. With 1 plate.

VEIGA (Octavio). Strongylose dos cavallos. Sua prophylaxia. [Equine Strongylosis. Prophylaxis.]—*Ann. Paulist. Med. e Cirurg.*, 1916. Oct. Vol. 7. No. 4. Year 4. pp. 91–95.

WARD (H. B.) & MAGATH (T. B.). Notes on Some Nematodes from Fresh-Water Fishes.—*Jl. Parasit.*, 1916. Dec. Vol. 3. No. 2. pp. 57–64. With 1 plate.

YOSHIDA (Sadao). On a Trematode Larva Encysted in a Crab, *Helice tridens* (de Haan).—*Jl. Parasit.*, 1916. Dec. Vol. 3. No. 2. pp. 65–75. With 2 text figs.

MYCOTIC DISEASES.

BEAUVERIE (J.). Les moisissures des tourteaux d'Arachide cultivant à 37°. [Moulds of Earth-Nut Cake cultivable at 37° C.]—*C.R. Soc. Biol.*, 1917. Mar. 17. Vol. 80. No. 6. pp. 311–313.

BRINGARD. Pseudo-tuberculose mycosique chez un cheval sud-américan. —*Rec. Méd. Vét.*, 1917. Jan. 15–Feb. 15. Vol. 93. Nos. 1 and 2. pp. 33–34.

CAZALBOU. Au sujet de la traitement de la lymphangite épizootique.—*Rec. Méd. Vét.*, 1917. Mar. 30. Vol. 92. No. 6. pp. 121–125.

CHÉNIER. Sur la lymphangite epizootique.—*Rev. Path., Comp.* 1917. Feb. Vol. 17. No. 131. pp. 11–15.

FAVERO (A.). Stenosi dell' ileo da actinomicoma in una cavalla. [Stenosis of the Ileum caused by an Actinomycoma in a Mare.]—*Moderno Zooiatro*, 1916. Oct. 31. Vol. 5. No. 10. pp. 237–246.

GUILLIERMOND (A.). Sur la division nucléaire des levures. [Nuclear Division in Yeasts.]—*Ann. Inst. Pasteur*, 1917. Mar. Vol. 31. No. 3. pp. 107–113. With 1 plate comprising 33 figs.

DISEASES DUE TO ULTRA-VISIBLE VIRUSES.

HOFFMANN (J. A.). Heilung von akuter Schweineseuche mit Methyleneblau. [Curative Treatment of Acute Swine Fever by Means of Methylene Blue.]—*Berlin. Tier. Woch.*, 1917. Mar. 1. Vol. 33. No. 9. pp. 101–102.

HUNTEMÜLLER. Kritische Studien über Morphologie und Züchtung von filtrierbaren Virusarten. [Critical Studies on the Morphology and Cultivation of the Filtrable Viruses.]—*Cent. f. Bakt.* I. Abt. Orig., 1916. Dec. 19. Vol. 79. No. 1. pp. 36–40. With 3 figs.

HUTYRA (F.) & KÖVES (J.). Experimentelle Studien über die Aetiologie und Immunität bei der Schweinepest. [Etiology and Immunity in Swine Fever.]—*Cent. f. Bakt.* 1. Abt. Orig., 1916. July 31. Vol. 78. No. 3. pp. 160–196. With 25 tables.

LOPEZ (C.). Diagnostico Bacteriologico de la Perineumonia Bovina empleo y valor de la Reaccion de Fijación (Nota Previa). [The Value of the Complement Test in the Diagnosis of Bovine Pleuropneumonia.]—*Treballs de la Societat de Biologica*, 1915. Barcelona.

MATTHIESEN & GLASSER. Versuch zur Bekämpfung der Maul- und Klauenseuche mit "Mallebrein." [The Treatment of Foot and Mouth Disease with "Mallebrein."]—*Berlin. Tier. Woch.*, 1917. Mar. 1. Vol. 33. No. 9. pp. 99–101.

MODERNO ZOOIATRO. Parte Professionale.—1917. Apr. 7. Vol. 5. No. 14. pp. 121–122. Un importante scoperta sull' immunizzazione contro l'afta epizootica. [An Important Discovery in Immunisation against Foot and Mouth Disease.]

PFEILER (W.) & STANDFUSS (R.). Ueber Versuche zur Schutzimpfung gegen Schweinepest mit sensibilisierten Virus. [Experiments upon Immunisation against Swine Fever by Means of a Sensitised Virus.]—*Zeitsch. f. Hyg. u. Infektionskr.*, 1916. Sept. 4. Vol. 25. No. 2. pp. 184–193.

DU TOIT (P. J.). Ueber das Kontagium der Rinderpest. Ein kritisches Sammelreferat. [Contagion in Rinderpest. A Critical Review of the Literature.]—*Zeitsch. f. Infektionskr., parasit. Krankheit. u. Hyg. d. Haustiere*, 1916. Nov. 18. No. 2. pp. 181–216.

BACTERIAL DISEASES.

Canelli (Adolfo F.). Dell' "Agglutinazione Paradossa" del *Micrococcus melitensis.* ["Paradoxical Agglutination" of *M.m.*]—*Pathologica.* 1917. Jan. 15. Vol. 9. No. 196. pp. 23–24.

Edmonds (C. R.) & Pinchin (G.). Quarter Evil.—*Rhodesia Agric. Jl.,* 1917. Feb. Vol. 14. No. 1. pp. 43–46.

Hardenbergh (J. B.) & Boerner (F.). Vaccinations against Haemorrhagic Septicaemia. No. 2.—*Jl. American Vet. Med. Assoc.,* 1917. Mar. Vol. 3. No. 7. pp. 868–876. With 2 tables.

Holman (W. L.). Spontaneous Infection of the Guinea-pig.—*Jl. Med. Res.,* 1916. Nov. Vol. 35. No. 2. pp. 151–186.

Pfeiler (W.). Die Erkennung der bakteriellen Infektionskrankheiten mittels der Präzipitationsmethode. [Diagnosis of Bacterial Diseases by Means of the Precipitin Test.]—*Zeitsch. f. Intektionskr., parasit. Krankh. u. Hyg. d. Haustiere,* 1916. Sept. & 1917, Feb. Vol. 18. Nos. 1 & 3. pp. 81–115 & 256–300.

—— & Roerke (E.). Zweite Mitteilung über das Auftreten des Hühnertyphus und die Eigenschaften seines Erregers. [Second Report on the Occurrence of Fowl Typhus and the Properties of its Causal Organism.]—*Cent. f. Bakt.* I. Abt. Orig., 1917. Feb. 28. Vol. 79. No. 3. pp. 125–139. With 4 tables.

Wüstenberg (H.). Besitzt der lebende Milzbrandbazillus eine Kapsel? Unter welchen Einflüssen entsteht die Kapsel? [Does the Living Anthrax Bacillus possess a Capsule? Under what Influences does the Capsule arise?]—*Arch. f. Wiss. u. Prakt. Tierheilk.,* 1916. Dec. 30. Vol. 43. No. 1. pp. 49–76. With 3 text figs.

MISCELLANEOUS.

Bengal. Annual Report of the Bengal Veterinary College and of the Civil Veterinary Department, Bengal, for the year 1915–16. 27 pp. f'cap. 1916. Calcutta: The Bengal Secretariat Book Depôt. [Price—Indian, 7 annas; English, 8*d.*]

Berthelot (Albert). Sur l'emploi du bouillon de légumes comme milieu de culture. [The Use of Vegetable Broth as Culture Medium.]—*C.R. Soc. Biol.,* 1917. Feb. 3 Vol. 80. No. 3. pp. 131–132.

Bridré (J.). Examen microscopique des frottis sans coloration. [Microscopic Examination of Smears without Staining.]—*C.R. Soc. Biol.,* 1917. Mar. 31. Vol. 80. No. 7. p. 332.

Cross (H. E.). A Note on the Action of Purgatives on the Camel. 6 pp. 1917. Lahore: Supt. Govt. Printing, Punjab.

Cushny (A. R.) & Yagi (S.). On the Action of Cobra Venom. Parts 1 & 2.—*Phil. Trans. Roy. Soc.,* London, 1916. Ser. B. Vol. 208. No. B 348. pp. 1–36. With 11 figs.

Danysz (J.). Les propriétés physicochimiques des produits du groupe des arsénobenzènes. Leurs transformations dans l'organisme. [Physico-chemical Properties of Products of the Arsenobenzene Group. Their Transformations in the Animal Body.]—*Ann. Inst. Pasteur,* 1917. Mar. Vol. 31. No. 3. pp. 114–137.

Eichhorn (A.). Vesicular Stomatitis in Cattle.—*American Jl. Vet. Med.,* 1917. Mar. Vol. 12. No. 3. pp. 162 and 170.

FLEISCHER (M. S.). The Influence of Serum upon the Staining of Bacteria in Suspensions.—*Jl. Med. Res.*, 1917. Mar. Vol. 36. No. 1. pp. 31–49.

FREI (W.) & MITTELHOLZER (J.). Zur Lehre von der innern Desinfektion. [The Theory of Internal Disinfection.]—*Zeitsch. f. Infektionskr. parasit. Krankheit. u. Hyg. Haustiere*, 1916. Nov. Vol. 18. Nos. 2 & 3. pp. 117–161 & 229–255.

LOCKEMANN (G.). Vergleichende Untersuchungen über die Arsenausscheidung durch den menschlichen Harn nach Injektion verschiedener Arsenikalien (Atoxyl, Arsacetin, Arsenophenylglycin, Salvarsan, Neosalvarsan). [Comparative Tests on Excretion of Arsenic in Human Urine following Injection of various Arsenical Salts.]—*Biochemische Zeitschr.* 1916. Nov. Vol. 68. Nos. 1 and 2. pp. 1–36.

LIONNET (F. E.). Animal Diseases Regulations with Notes on Diagnoses. —*Mauritius Dept. of Agriculture. General Series. Bulletin.* No. 7. 26 pp. 1916. Port Louis: Govt. Printer.

MADRAS. Annual Administration Report of the Civil Veterinary Department, Madras Presidency for 1915–1916. 25 pp. f'cap. With 1 map. Madras: Superintendent, Government Press, 1916.

DE NEUTER (C.). L'Elevage du Bétail et les Cultures sur les Bianos et dans la vallée de Kapiri, en mars, 1915.—*Bull. Agric. Congo Belge*, 1915. Mar.–June. Vol. 6. Nos. 1–2. pp. 92–98.

VAN RAES (L.). Rapport sur l' Etat sanitaire des animaux domestiques à Elizabethville (Katanga), durant l'année, 1914.—*Bull. Agric. Congo Belge*, 1915. Mar.–June. Vol. 6. Nos. 1–2. pp. 99–107.

RANGEL PESTANO (Bruno). Notas sobre o veneno de cobras das especies brasileiras. [The Venom of Brazilian Species of Cobra.]—*Ann. Paulist. Med. e Cirurg.*, 1916. May. Vol. 6. No. 5. pp. 108–112.

RETTERER (Éd.) & NEUVILLE (H.). Du développement et des homologies du gland des Ovinés, des Antilopinés et des Bovinés. [Development and Comparative Anatomy of the Glans Penis in Ovines, Antelopes and Bovines.]—*C.R. Soc. Biol.*, 1917. Mar. 31. Vol. 80. No. 7. pp. 339–343.

VELU. Role pathogène d'une graminée marocaine. [Pathogenicity of a Moroccan Grass (*Stipa Tortilis.*)]—*Rec. Méd. Vét.*, 1917 Jan. 15–Feb. 15. Vol. 93. Nos. 1 & 2. pp. 28–30.

For CONTENTS, see pages 3 & 4 of Cover

pp. 141-220.] [September 30, 1917.

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TROPICAL VETERINARY BULLETIN.

Vol. 5.] 1917. [No. 3.

DISEASES DUE TO PROTOZOAN PARASITES.

(a) Leishmaniasis.

Laveran (A.) & Havet (J.). **Contribution à l'étude de la leishmaniose viscérale naturelle du chien.** [Natural Leishmaniasis of the Dog.]—*Bull. Soc. Path. Exot.* 1917. May. Vol. 10. No. 5. pp. 386–392. With 1 fig.

A young bitch inoculated intravenously with the bone marrow of a dog infected with naturally contracted canine leishmaniasis (first passage from a dog received from Tunis) died 117 days after inoculation. Death occurred as the result of abdominal haemorrhage due to rupture of the spleen capsule; post-mortem examination revealed very noteworthy lesions in the spleen and liver.

The spleen weighed 345 grammes, that is, about 17 times the normal weight of the spleen of a dog weighing 10 kilogrammes. A rupture of the capsule was found on the external surface of the organ; the parenchyma was much softened and contained a haemorrhagic centre and two infarcts. The liver was larger and lighter in colour than normal; the bone marrow was red and diffluent.

Microscopic examination showed very considerable numbers of Leishmania in the bone marrow, in the spleen, and in the liver.

In the bone marrow the Leishmania were found free-lying or enclosed within the cellular elements, principally the bone marrow cells, and sometimes within the nuclei of these cells.

In the spleen the leucocytes principally contained the parasites; the connective tissue cells and the endothelial cells of the capillaries were also found invaded. Sometimes Leishmania were found in the interior of the nuclei of the cells.

In the liver the hepatic cells were observed to be the predilection seat of the parasites. Leishmania were also found in connective tissue cells, in plasma cells, and in the capillary blood vessels but to a far less extent. The authors' observations do not agree upon this point with those of Christophers and of Statham; according to these observers the predilection seat of Leishmania in human kala azar is the endothelial cells of the capillary blood vessels. Marked alterations were found by the authors in the structure of the liver.

(C393) Wt. P2/33. 650. 10.17. B.F.&Ltd. Gp.1/15. A

LAVERAN (A.). **Boutons d'Orient expérimentaux chez un** *Cercopithecus mona* **et chez un** *Cercocebus fuliginosus*. [The Production of Experimental Oriental Boils in a *C.m.* and a *C.f.*]—*Bull. Soc. Path. Exot.* 1917. April. Vol. 10. No. 4. pp. 291–293.

In this short article Laveran describes observations dealing with the experimental transmission of *Leishmania tropica* from an infected mouse to two more species of monkeys; the author had already effected transmission to four species. The two monkeys now experimented on were inoculated on the outer surface of the right thigh and both developed very marked oriental boils, thus producing as satisfactory a result as in the case of the monkeys previously tested. It was interesting in the case of the *Cercocebus fuliginosus* or "mangabey," which appears to be immune towards *Trypanosoma gambiense*, to find out whether the inoculation of oriental boil would succeed as well as in the case of the species already known to be sensitive to this virus and to *T. gambiense*.

LAVERAN (A.). **Boutons d'Orient chez un Mandrill.** [Oriental Boils in a Mandrill.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 455–456.

In this note Laveran announces the infection of another species of monkey with *L. tropica* from infected mice. The mandrill (*Mormon maimon*) was inoculated in the usual way by puncturing the skin three times on the outer surface of the right thigh. Six days afterwards small hard swellings appeared containing numerous Leishmania. The boils increased in size and in three weeks were about the size of large peas and began to ulcerate. Later, the boils increased further in size, became extensively ulcerated, and suppurated; the parasites became fewer and presented a degenerated appearance. After a month the swellings diminished in size, the parasites disappeared, until in six weeks time the lesions had become cicatrised, leaving only small intradermal thickenings.

(b) SPIROCHAETOSIS.

LEGER (André) & LE GALLEN (R.). **Spirochétose des poules au Sénégal. Son évolution clinique.** [Fowl Spirochaetosis in Senegal. Its Clinical Course.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 435–438.

The above disease is a very common and serious affection among fowls in Senegal causing great losses during the dry season and becoming less intense or even disappearing at the commencement of the rainy season. The causal organism is *Spirochaeta neveuxi* Brumpt, 1909, an organism almost identical in appearance with the ordinary *Sp. gallinarum* but differing from it inasmuch as immunity set up against the one organism does not protect against infection by the other. The pathogenicity of the spirochaete studied by BRUMPT differs a little from that of the authors' organism in that recovery is not the rule.

Twenty-five susceptible young fowls, free from Argas, placed in an infected run, commenced after a period of from five to seven days to show the usual symptoms, viz., more or less intense diarrhoea, depression, inappetence, fever, feathers erect and dirty-looking, and dull and flabby comb. Microscopic examination of the blood revealed numerous spirochaetes, but the mortality at this stage was inconsiderable; two pullets only succumbed.

The course of the disease thenceforward may lead directly towards recovery; thus four fowls after presenting spirochaetes in their blood for from seven to eight days afterwards showed no abnormality and became definitely cured. Generally, however, after the onset of the crisis the condition of the animal changes, becoming slightly better. The appetite improves a little and the diarrhoea is markedly lessened. There only remains a condition of intense anaemia. This stage lasts about a fortnight, then a number of secondary symptoms set in, and at the same time the red blood corpuscles show a number of the so-called "after-phase" bodies of BALFOUR.

In this secondary stage one may observe symptoms of two different degrees of severity. In the first place, the wasting may become progressive in spite of the appetite having recovered, the comb becomes covered with crusts which gradually extend over the whole head especially along the eyelids, and underneath these crusts, which are easily separated, are seen smooth ulcers exuding a serous liquid. Symptoms of partial paralysis also set in but these are usually transitory. Four out of 19 pullets which had arrived at this stage recovered.

In the second place, the above symptoms may continue to progress; the ulcerations affecting the head spread down the neck, and similar lesions develop on the breast and legs. A stinking viscous liquid flows from the beak, the eyelids become closed and underneath them a white caseous mass about the size of a hazel nut becomes formed and produces marked changes in the eye itself on account of pressure. In spite of the absence of fever the animal becomes extremely emaciated, but the appetite remains only slightly diminished. This second stage does not generally last more than from four to five months; 12 out of 15 pullets then died and 3 only survived; in spite of their serious condition the latter became completely cured.

BLANCHARD (R.). **Spirilles et Spirochètes.** [Spirilla and Spirochaetes.] —*Bull. Acad. Méd.* 1916. Nov. 7. Extracted in *Rec. Méd. Vét.* 1917. Apr. 15–May 15. Vol. 93. Nos. 7 & 8. pp. 225–226.

"The relationship existing between spirilla and spirochaetes is still the object of discussion. According to the author spirilla are large bacteria belonging consequently to the vegetable kingdom and live as saprophytes in water rich in organic matter. None of them is pathogenic or parasitic and in the actual state of knowledge there is no known spirillosis in man or in any animal.

"Spirochaetes are found in the bodies of man and of different animals; a large number are pathogenic and cause severe diseases, which are *spirochaetoses* (for example, recurrent fever, tick fever, ictero-haemorragica, syphilis). In spite of their resemblance to spirilla spirochaetes have the greatest affinities with the protozoa; they would thus belong to the animal kingdom. With the exception of syphilis spirochaetoses are inoculated diseases transmitted from one individual to another by the bite of an arthropod (acarian or insect).

"The conclusions of the distinguished professor are as follows:—

"(1) Spirilla should not be confused with spirochaetes as is done by a large number of authors.

"(2) The spirilla are neither pathogenic nor parasitic; a large number of spirochaetes are parasitic and pathogenic.

"(3) All the diseased conditions attributed to spirilla are due to spirochaetes. One knows of multiple examples of spirochaetoses; one does not know at present of any spirillosis, even on taking into consideration the whole animal series.

"(4) To speak in human or comparative pathology of spirilla and of spirillosis in cases of spirochaetes and spirochaetosis is not only to commit an error in language but also to ignore zoological and botanical nomenclature, without the observance of which scientific language could not attain rigorous precision; it amounts to breeding or maintaining inaccurate scientific notions which are very prejudicial to the progress and diffusion of science."

LEGER (André). **Spirochète de la musaraigne** (*Crocidura Stampflii* **Jentink**). [A Spirochaete of the Shrewmouse.]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 280–281.

Leger adds still another spirochaete to the list of those already found in the blood of mammals. The insectivorous host was caught in the sewers of Dakar, French Senegal. In the blood the spirochaetes were fairly numerous (1 per 15 fields of the microscope, $\frac{1}{15}$ inch Stiassnie lens) and presented fairly active movements. The organism was on an average from 14 to 16μ in length by about ·25μ in breadth and possessed four or five spirals; after staining it was seen as a straight or slightly curved spiral filament with whip-like extremities. The spirals were generally irregular in size measuring 2μ in width by 1 to 1·5μ in depth. Blood examination also revealed a large number of *Anaplasma marginale* and a very few parasites of the genus Grahamella. The pathogenicity of the spirochaete will be described later by the author. The name *Spirochaeta crociduræ* is given to the organism.

CARPANO (Matteo). **Su di uno spirochete osservato nel topo bianco** (*Mus rattus* **var.** *alba*) **e qualche considerazione su alcuni spirocheti saprofiti.** [A Spirochaete Observed in the White Rat and some Considerations on Certain Saprophytic Spirochaetes.]—*Nuovo Ercolani.* 1917. May 15 & 31. Vol. 22. Nos. 9 & 10. pp. 141–146 & 163–168. With 2 text figs.

A white rat which had been inoculated intraperitoneally with a broth culture of a streptococcus died after two days with lesions of intense peritonitis. In the peritoneal exudate, besides abundant streptococci, there was a considerable number of spirochaetes, some occurring singly, some in process of division, and some in clumps. In fresh preparations a number appeared to execute rather active movements while others were almost non-motile. The movements were of three types, propeller-like, serpentine, and a motion of contraction and expansion like the uncoiling of a spring.

The organisms were stained with difficulty; Ziehl's carbolfuchsin diluted and slightly heated, and Giemsa 1 in 10 applied for about 12 hours, gave the best results. When stained, single spirochaetes measured from 5 to 12μ by ·25μ in thickness and usually possessed from two to three large spirals. S-shaped and other forms were seen. The ends were often sharp but in some cases one end was apparently blunted. The interior often appeared to contain elongated granules with a nuclear appearance. Traces of a lateral membrane could be seen in some. There were no visible lateral or terminal cilia. Reproduction appeared to take place by transverse fission but a few elements appeared coupled closely parallel to each other. Spindle-shaped bacillary forms were also observed in the peritoneal exudate.

In the heart blood a few very scanty spirochaetes similar to those found in the peritoneal exudate were discoverable, but no spindle-shaped elements could be seen.

In the gastric and intestinal contents of this animal numerous spirochaetes were found of two distinct types, (1) stumpy elements from 6 to 12μ in length by 1μ in breadth with three or four shallow spirals and rounded ends, and (2) more numerous elements of the same nature as those seen in the peritoneal exudate and in the blood. In healthy rats belonging to the same lot as the above rat numerous microscopical examinations failed to reveal spirochaetes in the circulating blood; they were, however, easily distinguishable in the gastro-intestinal contents, especially in the caecum. Inoculation of a loopful of the peritoneal exudate from the dead rat into a healthy white rat produced no effect.

The author proceeds to discuss at length the significance of this secondary invasion with spirochaetes supervening on a streptococcic infection. A list of spirochaetes discovered by various authors in animals in health and disease is given. The author believes that many of these spirochaetes live normally as saprophytes in the digestive, excretory, or respiratory tract of animals, but probably play a considerable rôle as secondary invaders when the resistance of the membranes has been lowered by some disease-producing agent. The case of spirochaetes in the lesions of pigs infected with swine fever is quoted as one example.

(c) Piroplasmoses.

YAKIMOFF (W. L.), SCHOKHOR (N. J.), KOSELKINE (P. M.) & PAROÏSKY (P. S.). **Maladies animales du Turkestan russe à parasites endoglobulaires.** [Animal Diseases caused by Intracorpuscular Parasites in Russian Turkestan.]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 302–311.

The following are results published by the Commission appointed for investigating human and animal tropical diseases in Russian Turkestan, sent by the George Speyer Institute, Frankfort-on-Main, the Imperial Institute of Experimental Medicine of Petrograd, and the Veterinary Department of the Ministry of the Interior, Russia.

Piroplasmoses.—Bovine piroplasmosis had been recorded in Turkestan by KOVALEVSKY and STOLNIKOFF, but these authors probably confused two distinct diseases—piroplasmosis and theileriasis—as well as some bacterial diseases, as blood examinations were not always made; in one outbreak a mortality of 61·5 per cent. was recorded. Bovine piroplasmosis was identified by Yakimoff and his co-workers in two localities, the symptoms being similar to those of redwater in other countries. The *P. bigeminum* presented the usual morphological characters: pear-shaped forms 1·42 to $2{\cdot}13\mu \times 1$ to $1{\cdot}42\mu$, round forms 1·4 to $2{\cdot}13\mu$. Trypan blue gave very good results in the treatment of affected animals. Twenty-five cc. of a 1 per cent. solution in normal saline were injected; a total dose of from two to three grammes was sufficient even in the acute form. The parasites disappeared from the blood within 12 hours and the temperature came down. The cure was complete.

Equine piroplasmosis has existed for a long time in several localities in Turkestan. KOVALEVSKY (1909) discovered small round-shaped blood parasites characteristic of piroplasmosis on post-mortem examination of a horse. The authors themselves identified two species of parasites, viz., *Piroplasma caballi* and *Nuttallia equi*. The symptoms of the disease caused by *P. caballi* are fever, up to 41·4° C., pulse up to 100, thready in some cases, respiration up to 40 and of the abdominal type, loss of appetite, and depression; the eyelids are half closed, and sometimes there is lachrymation and petechiae on the conjunctival mucous membrane. The mucous membranes are coloured more or less yellow; the urine is thick and of a dark-yellow up to a reddish-brown colour; sometimes it contains albumin. The percentage of haemoglobin may fall down to 35. Decomposition sets in quickly after death and the fat and the serous membranes are stained yellow: there is then seen congestion of the internal organs, enlargement of the spleen, and serous exudate within the pericardial sac. The *P. caballi* of Turkestan was similar to that of other countries—single and bigeminate pear-shaped forms and rounded parasites.

In sheep the authors discovered piroplasms and Theileria in the case of slaughterhouse animals. Cases due to piroplasms were rarer than those due to Theileria. The piroplasms were of the large pear-shaped form and there was never more than one parasite in a single red corpuscle.

DSCHUNKOWSKY and LUHS (1907) first observed ovine piroplasmosis in the Transcaucasus, where the disease causes great losses. Yakimoff believes that according to the figures published by these two authors they were dealing with a mixed infection due to piroplasms and Theileria. The same authors (1909) discovered in the Transcaucasus a disease of goats in which they described small rounded-oval or elongated-oval parasites smaller in size than those found in sheep. It is probable that these also were not piroplasms but Theileria. SCHELLHASE (1913) described cases of goats infected with parasites of the type *Theileria mutans* in German East Africa. In a single case Yakimoff discovered a fairly large intracorpuscular parasite resembling a piroplasm in the blood of a goat in Turkestan.

The blood and spleens of a large number of dogs in several towns were examined but no case of piroplasmosis was discoverable.

On the other hand, piroplasmosis appears to be very widespread among wolves. In the slaughterhouse at Taschkente 75·9 per cent. were found infected. The degree of infection varied; as a rule the infection was latent and the parasites very rare. The parasites occurred as ring-shaped, small pear-shaped, and rarely rod-shaped forms; elements in the form of a Maltese cross were seen. Theileria and anaplasms were observed in conjunction with the piroplasms. The average size of the piroplasms was in the case of the rounded forms 1·42, bacillary forms 2·13, pear-shaped forms 1·5μ. Sometimes eight parasites could be seen in one corpuscle. In the case of one wolf killed on the Afghan frontier parasites resembling *P. canis* were found. It is recalled that NUTTALL and GRAHAM-SMITH failed to infect jackals with *P. canis*. PATTON (1910) discovered piroplasms, *P. gibsoni*, in Madras jackals and dogs, and NUTTALL (1910) found a piroplasm, *P. rossi*, in an African jackal.

Theileriases.—The authors noted some acute cases of theileriasis in bovines. Two animals were seen with a high temperature and general depression, but no other symptoms. Eighty per cent. of the red corpuscles were found invaded on examination of blood smears. After a few days the temperature became gradually lower and the number of parasites diminished but they did not disappear completely. In Turkestan there thus exist two forms of theileriasis, viz., an acute and a chronic form; the former lasts a few days and then becomes chronic; in the latter condition the parasites did not disappear entirely from the blood. The mild nature of the disease and the presence of parasites in the blood of healthy animals indicate that the Theileria of Turkestan is not *Th. parva*, but perhaps *Th. mutans* or a variety of this species. Calves inoculated with large quantities of infected blood developed in a few days a small number of Theileria which persisted but did not increase in number. Neosalvarsan and trypan blue injected intravenously failed to cause the disappearance of the parasites.

Theileria were found in smears from the blood of sheep killed at the Taschkente abattoirs. They were oval or pear-shaped in form, $1 \cdot 5\mu$ in length, with a small chromatin dot; rod-shaped parasites were very rare. Similar parasites have been described in sheep by SCHELLHASE (1913) in German East Africa, by MACFIE (1914) in Nigeria, and RODHAIN (1916) in the Belgian Congo. They were called *Theileria ovis* by the last-named author, and also prior to that date by Yakimoff in 1914.

Blood parasites which were believed to be Theileria (*Th. camelensis*) on account of their morphological characters were found in the blood of three camels. They were rounded in form with lightly staining reddish chromatin, few in number, and always occurring singly.

In the blood of one fox out of several examined a few Theileria were found in the form of rings each with a mass of chromatin.

Nuttalliases.—Several cases of nuttalliasis either alone or associated with piroplasmosis were found among horses. Clinically there was high temperature up to 41° C. or more, accelerated pulse (100), depression, jaundice, but no haemoglobinuria as in the case of the infection due to *P. caballi*. In blood smears four parasites were sometimes found together assuming the shape of a Maltese cross. One case was treated successfully by means of trypan blue, although THEILER states that this drug has no action upon *Nuttallia equi*. These parasites were found in about 2 per cent. of the horses killed at the Taschkente abattoirs; they were rounded or ring-shaped, rarely pear-shaped. The round forms were $1 \cdot 42$ to $2 \cdot 48\mu$ in diameter, the pear-shaped forms $0 \cdot 71\mu$ to $1 \cdot 42\mu \times 1 \cdot 42\mu$ to $2 \cdot 13\mu$. Nuttalliasis was found by DSCHUNKOWSKY and LUHS in the Transcaucasus.

Several cases of nuttalliasis were found among asses in one district. The parasites were rounded or slightly oval, and sometimes pear-shaped. The chromatin was well-developed. No division into four daughter parasites was observed. This disease was also observed in asses by DSCHUNKOWSKY and LUHS in the Transcaucasus.

Anaplasmoses.—Out of 193 bovines examined in one locality Theileria alone were found in the blood smears of 147, Theileria and anaplasms in 13, and anaplasms alone in one case only. The infection in bovines was probably first observed by STOLNIKOFF (1908), who mistook the causal organism for *Piroplasma annulatum*. *Anaplasma marginale* was the only form seen and never *A. centrale*. The parasites were of a regularly rounded shape and occurred singly and, rarely, in twos within the red corpuscles; sometimes forms undergoing division in the shape of a dumb-bell were seen. When associated with piroplasms the anaplasms were rare but they were numerous in the case of pure anaplasmosis. They stained of a deep violet colour with Giemsa, and were from 0·5 to 1·25μ in diameter.

Anaplasms were found in two horses, in one case associated with *N. equi* and in the other case alone. No anaplasms were found in asses.

The first case of anaplasmosis discovered by Yakimoff in dogs was found in a case severely infected with naturally-contracted leishmaniasis. Two other dogs inoculated with an emulsion of the organs of this dog became infected with leishmaniasis but not with anaplasmosis. Several cases of anaplasmosis were afterwards seen in dogs, but never in sheep and goats.

STOUTE (R. A.). **"Piroplasmosis" "Equine Malaria."**—*Jl. Amer. Vet. Med. Assoc.* 1917. May. Vol. 51. (New Ser. Vol. 4.) No. 2. p. 239.

A mare imported into Barbados, West Indies, from St. Croix showed symptoms commencing with inappetence six days after landing; two days later the appetite had disappeared. The following symptoms were then observed:—the conjunctival, buccal, and genital mucous membranes presented a yellow appearance; lachrymation; intermittent hurried pulse; quickened respiration; temperature 108° F.; great disinclination to move; marked constipation. The respiration was very rapid just before death. The blood smears, which were examined by the Bureau of Animal Industry, showed numerous piroplasms. The author is unable to suggest how this disease appeared in the West Indies.

(d) TRYPANOSOMIASIS.

HORNBY (H. E.). **Transmission of Cattle Trypanosomes by Flies other than Tsetse.**—*Rhodesia Agric. Jl.* 1917. Apr. Vol. 14. No. 2. pp. 168–176. With 1 plate comprising 2 figs.

In this article Hornby refers briefly to the existing knowledge with regard to the classification and transmission of trypanosomes. In Central Africa it has been shown that where the tsetse fly exists one always expects to find the domesticated animals affected with trypanosomiasis, and the same applies to Rhodesia. MONTGOMERY and KINGHORN (1908), however, concluded that "trypanosomes may be transmitted by *Glossina morsitans*, *Stomoxys calcitrans*, and a specimen of Lyperosia." BEVAN (1910), on the other hand, maintained that trypanosomiasis did not spread in the absence of the tsetse fly.

The author states that experience with fly-struck cattle in almost every part of N.E. Rhodesia, and in the adjoining parts of N.W. Rhodesia, Nyasaland and Portuguese East Africa has shown him that the vast majority of fly-struck cattle in these areas are infected with *T. pecorum*; only comparatively few were found to harbour *T. brucei* or *T. vivax*, although these trypanosomes are well represented in other parts of Rhodesia. In a district where *T. pecorum* and *G. morsitans* are both common it has been stated that if all the mammals and flies are examined only comparatively few of each lot would be found to harbour trypanosomes, nearly all the infected mammals being ruminants and all the affected flies being Glossina. Further, not all ruminants, nor all tsetse flies are susceptible, and in any fly belt it is exceptional to find more than 50 per cent. of the ruminants and 5 per cent. of the flies infected. Various authors have demonstrated that trypanosomes in other parts of the world can be and frequently are transmitted mechanically by flies other than tsetse flies. It remains to be shown that the Central African trypanosomes are often transmitted in a similar manner. JOWETT (1910 and 1911) showed that outbreaks of trypanosomiasis due to *T. congolense* (*pecorum*) frequently occurred in Portuguese East Africa in localities containing no tsetse flies but into which some animals had been brought from a distance and had been submitted en route to the attack of one or other species of Glossina; he further showed that Stomoxys or Haematopota were capable of transmitting the trypanosome mechanically. OWEN (1914) demonstrated that trypanosomiasis of cattle in N.W. Rhodesia was spread by a species of Tabanus; and JONES (1915) showed that the disease was spread in cattle near Beira by Tabanus or Hippobosca. BALFOUR in the Sudan and BRUCE in Nyasaland were both convinced of the important part that mechanical infection may play in spreading outbreaks due to *T. pecorum*; the latter observer blames Tabanus and Haematopota but considers that the evidence that Stomoxys plays a similar rôle is unsatisfactory. BRAUN (1914) in German East Africa stated that it was possible that in addition to tsetse flies other biting insects (Stomoxys and tabanids) transmitted *T. pecorum* (*congolense*).

In 1914 the author inoculated a dog with a strain of *T. brucei* vel *rhodesiense*; the dog afterwards showed numerous trypanosomes in the blood. The dog was allowed to cohabit with another dog, while the attacks of Stomoxys and haematophagous muscids caused severe excoriation of their ears. The uninoculated dog, subsequently fell ill and blood examination revealed numerous trypanosomes similar to those found in the other animal.

"The farming district of Fort Jameson is a 'fly-free' area almost completely surrounded by 'fly.' It is not a matter for surprise then that outbreaks of trypanosomiasis are constantly being reported from its periphery. I was soon impressed with the disproportion between the large number of animals affected and the small number (frequently *nil*) of tsetse that had been seen in the neighbourhood of the outbreak. Making all allowances for bad herding and straying cattle, it seemed impossible that, as was frequently the rule, an entire herd of fifty cattle could be infected by tsetse that no one had ever seen. Granted that the initial cause of the outbreak was a beast struck by a stray tsetse, it seemed probable that the disease was spread in the herd by some other agency. Then again, I have travelled through a district in December, just as the rains were starting, and of a thousand village cattle examined I have found less than a dozen to be fly-struck. I have travelled in the same district six months later, and found that five hundred of those previously examined were either dead or very ill from trypanosomiasis—on neither journey did I see a tsetse fly, although I know that from time to time odd ones are to be seen close to the district in question. This seasonal occurrence of the disease, coincident with the biting fly season, is significant."

The author then adds that in other districts where tsetse flies were scanty a large proportion of cattle became affected with trypanosomiasis. As experience has shown that less than 5 per cent. of Glossina are infective the large number of cases could not be entirely attributable to them. On some estates where the danger from mechanical infection has been realised and measures taken to isolate all fly-struck cattle, no fresh cases occurred during the last summer, although during each of the three previous ones severe outbreaks had been the rule.

The following footnote to this article is added by the Chief Veterinary Surgeon, Southern Rhodesia :—

"With regard to the conclusion that in certain circumstances trypanosomiasis in domestic animals is transmitted by biting flies other than tsetse, whilst this may be true for some areas, it is a very rare occurrence in Southern Rhodesia, where, as the result of the practical observation—no tsetse, no trypanosomiasis—it has not been found necessary to impose any veterinary regulations in respect to this disease."

MAYNARD (G. D.). **The Trypanosomes of Sleeping Sickness; being a Study of the Grounds for the Alleged Identity of *T. brucei* with those causing Disease in Man in Nyasaland.**—*The South African Institute for Medical Research. Publication No. 6.* 39 pp. With 1 table & 26 charts. Dec. 17. 1915. Johannesburg.

This publication consists of a detailed criticism of the findings of the Sleeping Sickness Commission of the Royal Society in its Report No. 16 [see this *Bulletin*, Vol. 3, No. 1, pp. 5–12]. "The Commission having satisfied itself that the Sleeping Sickness of Nyasaland and Rhodesia is caused by a trypanosome which, it states, is common in all fly-country and is spread from wild animals to man, recommends that efforts should be made to diminish, as far as possible, the number of wild animals in fly-areas."

Reference is made to the difficulties involved in exterminating game from the known African fly-areas and for the above recommendation to be valid two suppositions must be confirmed, viz. :—" (*a*) that wild game in all districts where *G. morsitans* is found are carriers of the trypanosome causing human trypanosomiasis, and (*b*) that if the game is eliminated the smaller animals will not act as carriers." Many ambiguities in the Commission's report are revealed by the author, and careful consideration of the far-reaching conclusions is advised before African governments should endeavour to carry them into effect.

The Commissioners consider that the morphology of the trypanosomes studied is a most important point, especially as regards length, and the numerous graphs of frequency-distributions of length-measurements indicate the value they place on this method of examination for the purpose of classification. Maynard points out that in common with other writers they "have discussed this point entirely from an inspectional standpoint, and appear to be unacquainted with the methods of the scientific analysis of such distribution, or of the statistical laws on which alone can sound deductions as to similarity or dis-similarity be based."

Karl PEARSON had already pointed out the great chances of error that might arise when trypanosomes are considered to be identical simply according to the method adopted by BRUCE and his colleagues. The greater part of the present paper is devoted to an intricate mathematical analysis, on the same lines as suggested by PEARSON, of the graphs of the various trypanosomes given in the Commission's report.

The author concludes from this study—

"1. That the analysis of length distributions shows that the dimorphic trypanosomes dealt with, viz., *T. rhodesiense*, *T. brucei*, *T. gambiense*, Trypanosomes of Nyasaland Sleeping Sickness, and Nyasaland wild game strain, have certain features in common. With some exceptions, which are not confined to any particular strain, the general character of resolution is similar.

"2. That there is some evidence to suggest that there is less similarity between the Nyasaland human strain and *T. brucei* than between *T. rhodesiense* of Stephens and Fantham and *T. gambiense* as recorded by these authors.

"3. That the analysis suggests that uniformity in treatment of strains, prior to the inoculation of rats, from which measurements are made, may be an important factor in determining the mean size and the variability of the components of the distributions.

"4. That at present no valid argument in regard to the identity or otherwise of *T. brucei* and the trypanosome causing disease in man in Nyasaland can be drawn from length-measurement-distributions.

"5. That this method of investigation may probably prove of service in the study of trypanosome species when proper analytical methods are employed at the time the investigations are being undertaken, but that nothing of value can be expected from an uncritical examination, or mere inspection, of the crude distributions."

The pathogenicity tests on laboratory animals of the various strains of trypanosomes studied by the Commission are then discussed and from the data the author infers "that at present the only valid argument in favour of the identity of the trypanosomes causing disease in man in Nyasaland with *T. brucei* is to be drawn from such experiments. There is some doubt, however, as to what weight should be attached to differences in period of illness before death, and, moreover, whether any stress should be laid on similarity in this respect in the absence of confirmation by other methods of investigation."

No differences in the trypanosomes can be noted by studying the carrier question. *T. rhodesiense* may be carried by *G. morsitans* and *G. brevipalpis*, *T. brucei* by *G. morsitans* and *G. pallidipes*, *T. gambiense* by *G. palpalis* and *G. morsitans*. The cycle of development in *G. morsitans* is similar for *T. brucei*, *T. rhodesiense* and *T. gambiense*.

With regard to cross immunity tests the experiments carried out by the Commission indicate that *T. brucei*, the Nyasaland human strain, the Nyasaland wild *G. morsitans* strain, and *T. rhodesiense* were not identical. Moreover, experiments carried out in the same direction by LAVERAN and NATTAN-LARRIER and MENSIL and LEGER tended to show that *T. rhodesiense* is not the same as *T. brucei*, and that a closer relationship exists between *T. gambiense* and *T. rhodesiense* than between *T. brucei* and either of these trypanosomes. Such experiments on the effects of various immune sera as have been undertaken "negative the supposition that *T. brucei* is identical, or even closely allied to the trypanosome causing Sleeping Sickness in man."

The importance attached to geographical distribution is indicated by the following quotation :—"The Commission thinks that, in addition to the morphology and action on animals, the geographical distribution of 'Nyasaland sleeping sickness,' or '*Trypanosoma brucei* disease' is the only way—experiments on man being impracticable—of showing that *Trypanosoma brucei* and *Trypanosoma rhodesiense* are one and the same." The author states—

"9. That there is no evidence at present from the known geographical distribution of *T. brucei* to suggest that it is a cause of Sleeping Sickness in man; and that even if it were found to produce disease in man this would, of itself, constitute no greater argument in favour of its identity with the Nyasaland human trypanosome than with *T. gambiense.*

"10. From the foregoing it would appear, therefore, that there is very little scientific evidence to support the contention that *T. brucei* and the trypanosome causing Sleeping Sickness in Nyasaland are the same species, while there are some very valid reasons for regarding them as distinct. Although the question may still be considered *sub judice* there does not seem to be any justification for entertaining a bias in favour of their identity. If this be admitted it follows that the recommendations of the Commission, which are based on their assumed identity, do not rest on a sure foundation of fact."

The author then enumerates a few hypotheses which suggested themselves in the course of this study as possible explanations of some of the facts. A priori it is unlikely that the Nyasaland human trypanosome is a newcomer into the country and thus it may be that (1) the Nyasaland disease is caused by the *T. gambiense* and that the increased virulence is due to the change of the invertebrate host, (2) that the human strain is derived from the wild game strain of the country, and (3) that it is the result of a dual infection with say, *T. gambiense* and a game strain. Various arguments in favour and against these theories are brought forward.

"It may be pointed out that unless an unmodified game strain be the cause of human trypanosomiasis—and the weight of evidence appears to me to be against this view—the human carrier is of much greater importance than the wild animal, and consequently the recommendations of the Commission cannot, unless considerably modified, be accepted as a satisfactory solution. The wholesale destruction of the big game of Africa cannot be accomplished without profoundly affecting the economic position in this Continent, nor, even if it could be satisfactorily carried out, can any positive guarantee at present be given that the situation in regard to Sleeping Sickness would be improved."

TEICHMANN (Ernst). **Mischinfektionsversuche mit Trypanosomen.** [Mixed Infections with Trypanosomes.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1916. Nov. 23. Vol. 82. No. 3. pp. 511–526. With 6 tables.

"The manner in which mixed trypanosome infections behave in mice was first investigated by A. LAVERAN and D. ROUDSKY (1912). They obtained strains without centrosomes from *Trypanosoma brucei, Trypanosoma evansi,* and *Trypanosoma soudanense* by the action of oxazine on these parasites. Such parasites mixed with normal individuals of the same strains were completely eliminated in from 2 to 10 mice passages. Afterwards R. OEHLER (1914) showed experimentally how artificially mixed infections with trypanosomes conducted themselves in mice. OEHLER obtained a pure strain by means of single cell transmission of a nagana strain (No. 4) maintained in our Institute. One branch of this strain was made drug-fast against salvarsan and another against tartar emetic, while another was not treated and thus remained sensitive to drugs. Each of the drug-fast subsidiary strains were then mixed with the drug-sensitive strain, inoculated into mice, and then carried on in these animals. In the course of passages the trypanosomes became separated and it always happened that the drug-fast components of the mixed infection gradually disappeared. OEHLER makes the difference in multiplication responsible

for the separation and he expresses the opinion that all acute strains ' that have been carried on for several passages must be regarded as pure—as pure as if they had originated from a single trypanosome.' "

It was obvious that in the course of passages a more quickly multiplying strain would ultimately lead to the suppression of a more slowly dividing trypanosome provided that the greater multiplication was also combined with stronger virulence. The question arises, however, as to what would happen in the case of a mixed infection with two or more strains possessing approximately the same power of multiplication and toxicity. The experiments described by the author in this paper were performed with the object of solving this problem.

Two nagana strains named Strain 4 and Strain 90 Fl., respectively, were used; these had been maintained in rats or mice and possessed approximately the same virulence in that they both killed mice in from four to six days after inoculation. Neither of these strains had been submitted to the action of any drug but Strain 4 had been shown to be very insensitive towards arsenic, while the other strain remained quite sensitive. The two strains also possessed immunological differences in that a serum immune against one strain had no protective powers against the other. Equal quantities of these two strains were then inoculated into five mice and a series of the passages made from each of these mice. At various passages the nature of the infective organisms was ascertained by determining the curative action of the sera immune against each of the original components on inoculated mice; the arsenic-fastness of the organisms was also tested by injection with arsacetin. At the 6th passage both elements were present in every case. In the case of one of the mixed strains the arsenic-fast element had become eliminated in the 10th passage; in the case of the other three mixed strains carried on both elements remained for a longer time, but at the 20th or 21st passage it was found that only the arsenic-fast strain remained; the remaining mixed strain was lost.

In order to make sure that one element had not been missed because of the small number present in the peripheral blood experiments were next made using for transmission the heart blood of infected mice 24 hours after inoculation, and tests were made at various passages as before. Separation, however, took place in the same way, but after a greater number of passages and this would probably be accounted for by the fact that the passages were made more quickly.

The question now arose as to whether a separation would take place in the case of two equally virulent trypanosome strains which set up a chronic infection after inoculation into mice. Tests by means of specific immune sera would not be possible in this case as the strains undergo marked antigenic changes in the course of a chronic infection. It is, however, possible to perform the experiment by utilising two trypanosomes which present morphological differences. Thus, a strain of *T. brucei* (Strain 63) obtained by the author from an ox in German East Africa, and the small East African trypanosome, *T. congolense* (Strain B), were used. Both these strains took about 30 days to kill a mouse; the remission period occurred earlier, about the 7th day, in *T. brucei* than in the case of *T. congolense*, 14th to 16th day. Mice inoculated with equal quantities of these chronic strains were examined daily as to the relative proportion of large and small trypanosomes in the blood. Sub-inoculations were made when they were present in equal quantities and also when one element considerably exceeded the other or was apparently absent under the microscope. In the case of the mixed strain obtained from one mouse separation occurred rather early, but in the case of the other four mixed strains it was not possible to obtain any separation although the experiments were carried on over three months.

Mixed infections are known to occur naturally. YORKE and BLACKLOCK (1911) observed a horse infected with *T. vivax* and *T. dimorphon*. BRAUN and TEICHMANN produced a mixed infection with *T. brucei* and *T. congolense* by feeding Glossina on rats at Amani, German East Africa.

The following are briefly the author's conclusions :—

"(1) In the case of a mixed infection with two equally virulent acute nagana strains separation takes place in the course of a few passages through mice.

"(2) The separation may take place by the elimination of one or other component.

"(3) Difference in sensitiveness of the components towards arsacetin exercises no appreciable influence on the direction in which the separation may take place.

"(4) The separation of two equally virulent nagana strains is also not prevented if the heart blood of the mice infected with the mixed strains is used for sub-inoculation.

"(5) In the case of mixed infection with strains (*T. brucei* and *T. congolense*) producing a chronic disease in mice separation of the components does not take place in consequence of the remissions which occur.

"(6) Exceptionally a separation can take place if one of the two components is indeed carried over in the course of sub-inoculation, but does not infect."

YAKIMOFF (W. L.) & WASSILEVSKY (W. J.). **Essais biologiques sur le luargol (102 de Danysz). Traitement de la dourine expérimentale des souris.** [Biological Tests on Luargol (Danysz's 102). Treatment of Experimental Dourine of Mice.]—*C. R. Soc. Biol.* 1917. Apr. 21. Vol. 80. No. 8. pp. 387–388.

The effects of luargol (an organic arsenical compound containing antimony, bromine, and silver) as well as its disodic compound were examined by the authors on normal mice and on mice infected with the Russian strain of dourine. It was found that 1 cc. of a 1 in 250 solution when injected intravenously killed normal mice in two days after injection, but that mice survived the injection of 1 cc. of weaker solutions, 1 in 300 to up to 1 in 800. The minimum fatal dose was thus 4 mgm. for a mouse weighing 20 grammes, and the maximum dose tolerated 3·3 mgm. These results indicated that luargol is less toxic than German and Russian salvarsan.

Mice infected with dourine, injected intravenously with solutions of 1 in 600 up to 1 in 900, recovered and were kept under observation afterwards for 60 days. In the case of infected mice treated with weaker solutions, 1 in 1,000 to 1 in 2,000, relapses occurred in from 11 to 20 days. The therapeutic dose was thus 1 cc. of a 1 in 900 solution, or 1·1 mgm.

The therapeutic index or the ratio between the minimum curative and the maximum tolerated dose is thus 1 : 3, which is better than that of salvarsan. The authors conclude that 102 is a very good chemotherapeutic agent.

WEHRBEIN (Heinrich). **Die Diagnose der Beschälseuche mittels der Konglutinationsmethode.** [The Diagnosis of Dourine by Means of the Conglutination Method.]—*Arch. f. Wiss. u. Prakt. Tierheilk.* 1917. Apr. 14. Vol. 43. Nos. 2 & 3. pp. 233–238.

The conglutination test closely resembles the deviation of the complement test except that in the final reading clumping of the blood corpuscles instead of haemolysis serves as the indicator. The test was studied by STRANIGG as applied to the diagnosis of glanders and it was also applied by EHRLICH, BORDET, and STRENG to detect the presence of antibodies against various bacteria and other albuminous products.

Careful titration of the various reagents is necessary. The author uses fresh horse serum as complement. This loses its activity on standing after six to seven hours but in the case of a healthy horse its titer remains constant and need not be determined for each experiment. A horse is selected possessing a serum with the highest complement titer. Some horse-sera agglutinate the corpuscles to a high degree and should be avoided.

The sheep blood emulsion should be of constant thickness and is added in the proportion of 0·1 of a 5 per cent. emulsion.

The antigen consists of pure trypanosomes obtained by repeated centrifugation from the blood of infected rats. An emulsion of 1 in 100 is made up.

A suitable ox serum must be obtained for conglutinating the sheep blood corpuscles. The best titer is 0·1 when 0·1 horse-serum is used as complement with 0·1 of a 5 per cent. emulsion of sheep corpuscles.

The reaction is usually read off three hours after the addition of the inactivated ox serum and the sheep corpuscles. The suitability of each lot of antigen is tested with a serum from a known dourine-infected horse and from a known normal horse.

The serum to be tested must be sterile. Putrefaction or the addition of chemicals is fatal to the test. The sera are inactivated for half an hour at 59° C.

The reading of the test is easy in a good system. With a positive result all the corpuscles are clumped together and with a negative serum there is no trace of clumping.

Nineteen dourine sera gave positive results corresponding with those given by the ordinary deviation of the complement test, and to a large extent with the agglutination test, with one exception in which an animal that had been infected for a considerable time and had then been treated with atoxyl ceased to give a positive result with the complement test, but continued to react strongly according to the conglutination test. Thirty normal sera gave negative results, except at first in two cases where errors of technique were detected.

The author's conclusion to a very incomplete description of his test is as follows:—

"The conglutination test is applicable for the diagnosis of dourine sera, but it is more sensitive to errors, and therefore more difficult to carry out than the ordinary deviation of the complement method."

DYKINS (W. A.). & JONES (R. P.). **Experiments conducted with a View to ascertaining the Toxicity of Certain Drugs injected Intravenously, and the Action of Same, if any, on Trypanosomes causing Trypanosomiasis in German East Africa.**—*Vet. Record.* 1917. Apr. 7. Vol. 29. No. 1500. pp. 415–416.

Nearly all the animals of the regiments in the veterinary charge of the authors were infected with trypanosomiasis, and, as no hope was entertained of their recovery, some experiments were performed on animals in the last stages of the disease with the object of ascertaining the minimum toxic doses of certain drugs when administered intravenously.

No toxic effects were observed after the administration of 25 grains of arsenic, 500 cc. of a 1 in 1,000 solution of perchloride of mercury, fifteen grains of arsenic and 200 cc. of a 1 in 1,000 solution of perchloride of mercury, 150 cc. of a 2 per cent. solution of calx chlorinata, 100 cc. of hypochlorous acid, 300 cc. of a 1 per cent. solution copper sulphate. "All the animals which died died of trypanosomiasis and not as the result of the injections." The minimum toxic dose was not definitely ascertained in any case. "Except in cases injected with the solution of copper sulphate, the effects of which are open to doubt, in no case did we discover any drug with an inhibitory action on trypanosomes."

DELANOË (P.). **Contribution à l'étude du pouvoir pathogène du Trypanosome de Mazagan.** [Pathogenicity of the Mazagan Trypanosome.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 501–512.

In this memoir the author discusses the susceptibility of the various laboratory animals to subcutaneous or intraperitoneal inoculation of virus obtained from the naturally infected horse.

Rabbit.—All rabbits inoculated proved susceptible and the disease ran a more or less chronic course. Death occurred in from 2 to 11 months. The trypanosomes could be demonstrated only at irregular intervals in the peripheral blood, and generally they were few in number. Auto-agglutination of the red blood corpuscles is very distinct and may exist before the trypanosomes appear in the blood.

Severe external lesions appear commencing from 20 to 25 days after inoculation. These first take the form of marked swellings of the conjunctival and nasal mucous membranes together with the formation of crusty muco-purulent discharges on these places. No keratitis, however, appears. The ears become tumefied and hairless and filled with dried-up scaly crusts. Hairless, crusty, symmetrically-placed patches appear on the dorso-lumbar region. Lesions of the genital organs are also distinct, the sheath and the vulva becoming swollen, dry, wrinkled, and crusty in appearance. These lesions become progressively intense during the course of the disease, but the appetite remains normal throughout.

On post-mortem examination no swelling of the spleen is observable; the liver, however, is congested and enlarged, and often attacked with fatty degeneration. In one case the heart was found affected with very advanced fatty degeneration.

Guinea-pig.—A small number of guinea-pigs, infected with the trypanosome after a series of passages through various experimental animals, all proved susceptible and death occurred in from 36 days up to 4 months after inoculation. The trypanosomes could be found at certain periods only in the peripheral blood but when present they were nearly always very numerous. The trypanosomes disappeared abruptly from the blood during the crises. The external lesions were less marked than in the case of the rabbit. The most marked lesions consisted in an intense oedema along the inguinal and external genital regions.

Dog.—This animal is very susceptible contracting a sub-acute infection. The period of incubation was about eight days, and death, which occurred in all cases, took place in from two to four months after inoculation. When present in the blood the trypanosomes are numerous, but they may disappear abruptly from time to time. Auto-agglutination of the corpuscles is often very pronounced and may appear before the trypanosomes in the peripheral blood. The trypanosomes also become agglutinated, forming relatively large clumps.

One dog out of three showed a double keratitis, but no swelling of the eyelids or conjunctiva, and this animal became affected also with multiple abrasions on the fore quarters. The other dogs showed no such lesions. In all cases the animals became affected with a gradually progressive loss of condition until they finally became extremely emaciated, affected with partial paralysis of the hind quarters and respiratory distress.

On post-mortem examination there is distinct swelling of the spleen, and swelling and degeneration of the liver.

White mouse.—This animal is invariably susceptible, but, according to the virulence of the trypanosome, it may show two distinct types of infection; that is, after a period of incubation there may be a continuous and progressive multiplication of the trypanosomes in the blood up to the time of death, or, on the other hand, the disease may run a more prolonged course accompanied by crises or recurrent appearance and disappearance of trypanosomes in the blood. The first type of infection was set up after inoculation with the primary virus obtained from the horse and also in successive passages through mice; the second type was observed after passing the virus beforehand through the dog and rabbit. The period of incubation thus varied from 2 up to 9 days, and the course of the disease was from 6 to 36 days, death taking place after the shortest interval when the trypanosome had been passed through a series of five mice. Auto-agglutination was not very marked. On post-mortem examination the spleen showed marked enlargement.

White rat.—The period of incubation was about 5 days and death occurred in from 18 to 23 days after inoculation from a naturally infected horse, but after three passages it occurred in 5 days. The infection is thus acute in this animal. Very marked swelling of the spleen and congestion and fatty degeneration of the liver is observable in the dead animals.

Alexandria rat.—The infection may be acute or chronic. After infection with virus from a white rat death took place on the 6th day with extremely numerous trypanosomes in the blood and enlargement of the spleen. On the other hand a rat inoculated with virus from a gerbil after passage through a long series of other animals showed a very typical chronic infection, with trypanosomes rarely present in the blood and subsequent recovery.

Gerbil.—This animal is very susceptible, the period of incubation being only from 2 to 3 days. The trypanosomes are very numerous on the 4th day, and then show distinct agglutination. Auto-agglutination of the corpuscles, however, is not observable. One female gerbil gave birth, after inoculation, to seven young, which remained healthy. The mother which in the meantime showed distinct lesions about the nostrils was eaten up after death by her grown-up progeny, and two of these became subsequently infected with trypanosomiasis. Infection by ingestion of an infected dead animal was also shown in another experiment; the period of incubation in this case lasted from 8 to 11 days.

Inoculation of large quantities of virus into fowls and geese gave negative results.

DELANOË (P.). **De l'existence à Mazagan et dans le Cercle des Doukkala (Maroc Occidental) de *Trypanosoma Lewisi* Kent et de *Trypanosoma Duttoni* Thiroux.** [The Presence of *T. lewisi* and *T. duttoni* in Western Morocco.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 456–458.

T. lewisi was very commonly found by the author in rats (*Mus alexandrinus* Geoffroy) caught at Mazagan and in various outposts in the Doukkala district. In certain places almost all the rats were infected. No trypanosomes were, however, found in the gerbils which are very common in this region. *T. lewisi* was, on the other hand, shown to be infective for these animals. Two gerbils thus inoculated intraperitoneally with infected rat blood developed in one case an infection for a short period confined to the peritoneal cavity, and in the other case the trypanosomes became generalised but here also the infection was mostly intraperitoneal and lasted only fourteen days.

T. duttoni is much less common at Mazagan than *T. lewisi* Out of 43 grey mice (*Mus musculus spretus* Lataste, 1883) one only was found infected. In smears stained by the Pappenheim method the trypanosome showed a thin lightly coloured undulating membrane, a blue cytoplasm without chromatinic granules, a rose-coloured nucleus and flagellum, and a deep violet blepharoplast. The dimensions were, total length $35 \cdot 4\mu$, free flagellum $6 \cdot 3\mu$, posterior extremity to blepharoplast $6 \cdot 5\mu$, blepharoplast to nucleus $8 \cdot 3\mu$, length of nucleus $4 \cdot 3\mu$. The trypanosome was easily maintained by passage through grey mice.

NOVY (F. G.), DEKRUIF (P. H.) & NOVY (R. L.). **Anaphylatoxin and Anaphylaxis. I. Trypanosome Anaphylatoxin.**—*Jl. Infect. Dis.* 1917. May. Vol. 20. No. 5. pp. 499–535. With 1 fig., 18 tables & 2 charts.

"In the course of experimental work on immunity against the trypanosomes of surra and nagana it was found that severe toxic effects with marked hypothermia often followed the injection of autolyzed suspensions of the organisms. When such injections were repeated the chronic intoxication thus induced usually ended fatally, and while a certain minimal

protection could be established in carefully treated animals, it was evident that the poisonous action observed was a bar to the production of a higher degree of immunity. As no advance seemed to be possible without a clear understanding of the nature of this intoxication, the trend of the investigation had to be changed into a new direction. At first the poisonous effects were identified with the 'trypanotoxin' of Laveran, but the similarity to that of the so-called anaphylatoxins was such that it led to a study of trypanosomes in their relation to the production of this poison."

The authors describe experiments dealing with anaphylatoxin-production with the surra, caderas and dourine trypanosomes, and *T. lewisi*. The nagana trypanosome is dealt with in greater detail. The methods employed in obtaining fresh serum aseptically from white rats, which were used most largely for experiment, and from guinea-pigs and rabbits are described.

The following is the authors' own summary of their experiments :—

"Anaphylatoxin was produced by 5 different trypanosomes, including the nonpathogenic *T. lewisi*.

"It is made not only by the living cells, but also by the dead, more or less autolyzed, cells, and even by such when heated to 60° C.

"The same mass of trypanosomes can be used repeatedly to toxify different lots of serum without apparently any limit to their inducing power. This serial production in one experiment extending over 8 days, was carried through 20 tests with no indication that the organisms were weaker than at the beginning.

"Rat serum is preferable to guinea-pig serum since it yields a poison which may be 12 or more times as active as that obtained with the latter; the respective lethal doses being 0·25 cc. of the former and 3 of the latter.

"The speed of poison-production under favorable conditions is very rapid and quickly reaches a maximum, the poison then persisting for a long time. Thus, infected defibrinated rat blood or serum, when incubated for 1 or 2 minutes, may become fatally toxic. With an incubation of about 15 minutes, it is possible to produce a toxic serum such that 0·25 cc. will cause acute anaphylactic death.

"Sera inactivated at 56° C. or 60° C. for half an hour apparently can be toxified.

"The anaphylatoxin was found to persist at 37° C. for more than 4 hours; at about 0° C. it may persist for an indefinite time. Thus, a surra serum was still toxic after icing for 171 days; a nagana serum was likewise active for 35 days. Attempts at detoxifying by addition of normal serum, bile, or cholesterin resulted negatively.

"Toxic sera can induce toxicity in normal sera, the mixtures representing a high dilution of the former. This result is not due to the action of a ferment, but to minute amounts of trypanosomes still present in the inciting serum; or, in the case of very prolonged incubation, to the production of autoanaphylatoxin.

"A comparison of the effects of different centrifugation-rates on chilled, rapidly defibrinated blood shows that sera obtained at slow speed readily become toxic; the sera secured at a very high speed do not.

"Transfusion experiments indicate the possible presence of anaphylatoxin in heavily infected rats. The formation of this poison in corpore may lead to sudden deaths or to chronic intoxication or cachexia.

"The injection of normal rat serum into infected guinea-pigs does not result in the in-vivo production of poison; any effect observed is due to the primary toxicity or autoanaphylatoxin of such injected serum.

"The toxicity of trypanosomal sera, when tested at regular intervals, appears to show more or less oscillation. Similar variations are met with in tests with anaphylatoxins produced by other agents, and even in normal sera. They are not due to changes in the amount of poison, but to varying resistance of the test animals.

"The injection of large amounts of washed trypanosomes into guinea-pigs may result in the production of anaphylatoxin in corpore. The effects are not due directly to the organisms, but to the disturbance in the colloidal state of plasma constituents, caused by the alien material.

"The 'trypanotoxins' are therefore disturbers of equilibrium; the result is a poison-production in vivo as well as in vitro. The mode of action of endotoxins in general will be found to be of the same nature.

"The participation of a ferment in this reaction is contra indicated by the speed of production, the rapid attainment of maximal level, the behavior of inactivated sera, and by the results of centrifugation.

"The syndrome of symptoms and autopsy findings consequent on the injection of the trypanosome anaphylatoxin are those of the intoxication of true anaphylaxis. The two poisonings are to be considered as identical."

MARTY (L.). i. **Agglutination et désagglutination des globules rouges dans la trypanosomiase.** [Agglutination and Disagglutination of the Red Blood Corpuscles in Trypanosomiasis.]—*Bull. Soc. Path. Exot.* 1917. May. Vol. 10. No. 5. pp. 392–398.

ii. **De la Pseudo-Agglutination des globules rouges dans quelques affections à parasites sanguicoles.** [Pseudo-Agglutination of the Red Blood Corpuscles in some Diseases due to Blood Parasites.] *Ibid.* June. No. 6. pp. 484–486.

These papers refer presumably to phenomena which have been observed only in the case of human diseases; an extract is here given as the changes described may prove of interest for a comparative study in similar chronic blood affections of animals.

i. If an average-sized drop of normal human blood is placed between slide and cover glass the red corpuscles are observed to become formed into rouleaux from 10 to 50μ in length, in which the corpuscles are apparently held together side by side by two forces acting in inverse directions. These forces, however, prevent clumping of the corpuscles. When regarded by means of the naked eye the preparation presents at places a very finely granular appearance and shows a pale colour except at its border, where on contact with the air the blood has coagulated, forming a continuous haemo-lute preventing a too rapid evaporation.

If one looks through a preparation of trypanosome-affected blood one finds that it quickly takes on a granular appearance throughout; the granules are very much larger, and the preparation, instead of being pale, is of a smoky red colour. Between this distinct appearance of macroscopical agglutination and that of normal blood various degress of agglutination can be observed. In doubtful cases it is necessary to use a No. 7 objective or an oil immersion lens.

If after 5 or 10 minutes one exerts a moderately strong pressure by means of a glass rod or the finger on the preparations of normal and trypanosome blood one finds that the local and very fine granulation in the normal blood disappears and never shows itself again. In the case of the other preparation it re-appears and if the operation is repeated after 15 minutes the same phenomenon occurs; after half-an-hour the granulation becomes changed presenting a reddish sandy-like appearance which persists for several hours.

As the result of the clumping in the trypanosome blood a deeper colour bordering on mahogany is noticed; also, the agglutinated corpuscles withstand crenation and fragmentation into the so-called globulids longer than ordinary red corpuscles.

If one examines the preparation of normal blood under the microscope the red corpuscles at the periphery are formed up close together, forming a zone of corpuscles which soon commence to undergo successively crenation and haemolysis. The haemo-lute protects the preparation fairly well from contact with the air, but its impermeability being only relative all the red corpuscles in the preparation soon become crenated; they then disappear in a structureless deliquium which becomes invaded with air bubbles when the serum evaporates. From time to time corpuscles are seen capable of withstanding crenation longer and split into two or three elements of unequal size (globulids) which disappear last of all in the deliquium.

In a preparation of trypanosome blood one notices that the red corpuscles at the periphery, instead of undergoing crenation, form up into several layers somewhat resembling the superficial strata of the epidermis. The corpuscles in this stratum remain a long time intact and even show the appearance of a piece of mahogany with annular rings, etc. The haemo-lute is much more of an independent structure than that of normal blood; from the deeper surface of the stratum there are seen some prolongations which remind one of the intrapapillary prolongations of the skin. If an air bubble strays into the stratum it immediately becomes surrounded by the corpuscles which form an onion-like mass around it. Later, when evaporation of the serum has progressed to a certain extent the covering stratum loses its continuity and breaks up into pliable columns floating in the lemon-coloured serum. The deeper masses glide smoothly in between obstacles without becoming broken up until they reach the central parts of the preparation. This resistance to disagglutination is characteristic of perfectly agglutinating masses. Behind this covering stratum are formed smaller clumps which diminish in size and number as one approaches the centre of the preparation.

In the preparations submitted to pressure as above described one notices that in the case of normal blood the longer rouleaux are split up into two or three small columns. The first pressure in the other case has the effect of dividing the corpuscles into two classes, viz., those which contribute to the formation of clumps, and those which having insufficient agglutinating power are broken up into globulids. In the case of the clumps after the first pressure the heaped up rouleaux are broken up but as soon as the pressure ceases the various pieces become bound up together to form larger clumps with irregular margins surrounded by globulids. The central part of the clump is of a deep yellow, sometimes mahogany, colour; the thinner periphery is of a straw-coloured yellow. The haemo-lute is also broken up but forms up again into a less regular and incontinuous stratum.

The same phenomenon is repeated when pressure is exerted again a quarter or half an hour later. The evaporation of the serum is accelerated and the clumps take on new characters. The red corpuscles in order to escape desiccation become bound up more closely together and their contours become very irregular, the upper layers of corpuscles being in continuous active movement.

The third pressure performed half-an-hour later accentuates the binding together of the clumps. There are then formed within them clear spaces which appear in the form of crescents at the borders or in the form of clear alveoli about the size of a corpuscle in the centre of a clump. The spaces may at times take on a copper colour.

A little later the vacuolisation of the clump is still more pronounced and it resembles an organ affected with fatty degeneration.

Towards the end, the massing of the corpuscles into clumps disappears; the attractive force becomes *nil*, and the clump spreads itself out. It is then seen under the form of sulphur-yellow flakes striated by the stellate outlines of the capsules of the red corpuscles. Last of all the striation or pattern work disappears and the clump undergoes a granular degeneration.

In order to study the phenomenon of agglutination-disagglutination it is better not to use a vaseline lute as this prevents the formation of the covering stratum. The most suitable drop of blood is that which only covers from two-thirds to three-quarters of the cover glass after slight pressure. Drops which cover the whole cover glass or only one-quarter to one-half are of no use for the study. After a first injection with atoxyl or, even better, following the injection of the second dose, the agglutination-disagglutination of the red corpuscles is increased to a marked extent. The phenomenon was not observed in other human diseases such as syphilis, yaws, malaria, and haemoglobinuric biliary fever.

ii. In other human affections due to blood parasites (spirochaetoses, malaria, and, to a lesser degree, in filariasis and in intestinal amoebiasis) an analogous phenomenon, which is less distinct and is hence called pseudo-agglutination, is observed in connection with the red corpuscles. In a very thin preparation this pseudo-agglutination is not seen. In a thick preparation the corpuscles form flakes of a laked appearance, more or less independent one from another. These may tend to cause confusion with the agglutination observed in trypanosomiasis. Preparations must be carefully made. An average sized drop of blood is placed on a slide and covered gently with a cover glass with the aid of a pair of forceps; a gentle and even pressure is exerted on the cover glass so as to spread the drop without crushing it.

Examined with the naked-eye the preparation shows no peculiarity. The rouleaux are slightly massed but there is no clumping by superposition. The alignment of the elements in the rouleaux is not perfect; in the neighbourhood of the haemo-lute the rouleaux are a little deeper in colour than normal, tend to collect together, and take on a varnished appearance. The same appearance is shown in slight trypanosome affections and in those which can be considered cured after a long treatment. After a shortly applied compression the rouleaux are broken up and do not form up again into mahogany-coloured spots. In the haemo-lute there are clusters of closely packed corpuscles but there is no stratum formation as in typical trypanosomiasis blood. Crenation of the corpuscles is more delayed than in the case of normal blood. The globulids are concomitants of the mahogany-coloured spots, that is to say, they are few and scattered in slight trypanosomiasis, but do not exist in cases of pseudo-agglutination.

The author attempted to intensify the agglutinating power of red corpuscles in trypanosomiasis so as to show up the mahogany-coloured spots more distinctly in the lighter forms of the disease. In a good preparation the blood covers about three-quarters of the cover glass and around the haemo-lute there remains an empty space between the slide and cover glass. By means of a platinum needle bent at right angles a drop of 1 in 1,000 potassium carbonate is placed on the edge of the cover glass. This drop quickly comes in contact with the haemo-lute by means of capillary attraction. The haemo-lute in trypanosomiasis withstands disintegration very well while in the case of pseudo-agglutination it is almost immediately disorganised and carried away with the liquid currents. The lemon-yellow clumps of uncertain significance in slight trypanosomiasis become more distinct and of a mahogany shade. The pseudo-clumps do not resist; in the case of syphilis or acute malaria there may form in the centre of the preparation outside the limits of the currents small clumps of from five to six corpuscles with irregular ragged borders of a deep colour. A slight pressure exerted on the centre of the cover glass causes them to disintegrate and set free the crenated corpuscles which are carried away by the currents and prevented from re-agglutinating.

The author concludes that an examination for the phenomenon of agglutination-disagglutination with its accompanying globulids enables one to establish a diagnosis in the majority of trypanosomiases. In the milder forms recourse must be taken to a test injection with atoxyl or, much more simply, to impregnation with 1 in 1,000 solution of potassium carbonate; this potassium salt, by increasing the agglutinating power of the red corpuscles, enables one to differentiate between a very slight trypanosomiasis agglutination and a pseudo-agglutination due to some other infestation.

(e) Miscellaneous.

Sanlorenzo (F.). **Coccidiose intestinale "dysenterie rouge" du boeuf en Piémont.** [Bovine Intestinal Coccidiosis or "Red Dysentery" in Piedmont, Northern Italy.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 446–447.

The above disease, which has been described by numerous authors in several countries, has not hitherto been recorded in Italy. Three cases of dysentery in cattle in the neighbourhood of Alessandria were found to have been caused by *Coccidium bovis* or *Eimeria zurni*, which was present in very large numbers in the faeces. The author believes that the disease is more widespread in Italy than is generally believed. Daily doses of 15 grains of thymol effected a cure in the author's cases.

Sergent (Etienne). **Sur des formes sans pigment ou à pigment très fin apparues chez le *Proteosoma* (*Plasmodium relictum* Grassi et Feletti) au cours de passages par canaris.** [Non-Pigmented Forms or Forms with Very Fine Pigment appearing in Proteosoma in the Course of Passage through Canaries.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 448–450. With 2 figs.

In the course of experiments on the immunity of birds towards Proteosoma peculiar forms were found in the blood corpuscles in rare instances (3 out of 700 canaries). The intraperitoneal injection of the infected blood from these cases into three other canaries reproduced the same forms. The parasites without pigment were young rounded forms capable of attaining a diameter equal to a third of that of the corpuscles. (In ordinary Proteosoma a large granule of black pigment appears always as soon as the parasite becomes visible within the corpuscle.) The parasites containing very fine pigment were larger than the preceding, generally placed alongside the nucleus, which sometimes was not displaced; the pigment was appreciably finer than that of normal Proteosoma and this difference was especially seen when examined in the fresh state. Simultaneously with these two forms there were seen the ordinary forms of Proteosoma with a large amount of pigment but the forms without pigment or with very fine pigment were always more numerous than the classical forms.

It thus appears that the author had under observation certain forms of Proteosoma capable of being reproduced by inoculation in the bird and he argues that by analogy this observation lends support to LAVERAN'S theory with regard to the unicity of the parasite of human malaria.

SERGENT (Etienne) & HEMPL (H.). **Sur l'immunité dans le paludism des oiseaux (*Proteosoma* vel *Plasmodium relictum* Grassi et Feletti).** [Immunity in Bird Malaria.]—*Bull. Soc. Path. Exot.* 1917. July. Vol. 10. No. 7. pp. 550–552. With 1 chart.

In bird malaria due to Proteosoma there is after the commencing acute infection a period of relative immunity. A test inoculation —intraperitoneal injection of blood which is certainly infective for control birds—does not cause the parasites to appear in the peripheral blood. Sometimes only a short and benign relapse sets in, with at times a short incubation period (one or two days). This accounts for the so-called acclimatisation of the old inhabitants of a fever stricken country. This immunity is acquired from the 6th day after the commencement of blood infection.

In the experiments described by the authors five canaries infected at least 2½ years previously showed, in the case of four, that the relative immunity had lasted over this period. The fifth showed after the test inoculation a very marked infection.

LAVERAN, in discussing this paper, states that the disease of birds studied by the authors has nothing in common with human malaria and that it is unfortunate that it should be designated under the name of bird malaria.

YAKIMOFF (W. L.) & SCHOKHOR (N. J.). **Leucocytogrégarine des chiens au Turkestan russe.** [Leucocytogregarine of Dogs in Russian Turkestan.]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 281–282.

The parasite described by the authors was identical with *Leucocytogregarina canis* James, 1905, and was found in 15 out of 151 dogs examined in various districts. The organisms were found in the peripheral blood, parenchymatous organs, and bone marrow. In the blood they were always intra-cellular, and in the organs almost always free-lying. They were of an elongated oval shape and slightly kidney-shaped. When stained each parasite showed a clear blue protoplasm containing sometimes a variable number of small granules, with a red-stained compact and finely granular nucleus situated sometimes towards one end. The membrane was colourless. A periplast was distinguishable.

Parasites belonging to the same species have been described by various authors in India, in the Malay States, French Indo-China, Lake Tanganyika, French Congo, Tunis, Baghdad, Italy, Algeria, and Corsica. Different species have been found in the blood of dogs in Upper Senegal and Nigeria, and Eritrea.

LEGER (M.) & MOUZELS (P.). **Hémogrégarine intraleucocytaire d'un saurien, *Tupinambis nigropunctatus*.** [A Haemogregarine found in the Leucocytes of a Lizard, *T. n.*]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 283–284.

The parasite described by the authors was found in the blood of one of the large richly coloured lizards found in Cayenne gardens. Its chief peculiarity was that it was found only within the leucocytes—the large and small mononuclears. The organism was enclosed within a very thin-walled cyst 9 to 11μ long by 5 to 7μ broad; it contained a nucleus of variable shape and a homogeneous protoplasm containing brightly staining chromatinic bodies disseminated throughout it. The haematozoon at first sight appeared oval but on closer examination was found to be 16 to 18μ long and folded back on itself, the tapering tail being bent back on the body.

Haemogregarines within the leucocytes of lizards have already been described by LAVERAN and others, but in those cases the majority of the parasites were found within the red corpuscles and other places. The authors propose the name *Haemogregarina weinbergi* for the parasite described by them.

BLANC (Georges). **Sur un cas de toxoplasmose canine observé en Tunisie.** [A Case of Canine Toxoplasmosis observed in Tunis.]—*Bull. Soc. Path. Exot.* 1917. May. Vol. 10. No. 5. pp. 377–378.

In this short note the author describes the first case of canine toxoplasmosis recorded in Tunis. The disease occurred in a dog that had been inoculated with crushed up material from the nymphae of ticks fed on a dog affected with kala azar. The dog died a month afterwards without in the meantime showing any symptoms, and on post-mortem examination toxoplasms were found in its organs but no Leishmania. Another dog treated in the same way became emaciated and developed conjunctivitis and opacity of both corneae, but no Leishmania or toxoplasms were discoverable on post-mortem examination. A fact of importance was that the dog affected with toxoplasms was kept in the same building as a number of gondi. Naturally occurring toxoplasmosis had been observed regularly for several years in autumn and in winter among these gondi, and the infection may possibly have been transmitted from them by means of larvae of ticks to the dog.

YAKIMOFF (W. L.). **Trichomonas de l'intestin de la sangsue du Turkestan (*Limnatis turkestanica*.).** [Trichomonas in the Intestine of the Turkestan Leech.]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 293–294.

Trichomonas have been observed in man and in several warm-blooded animals as well as in some cold-blooded animals. BRUMPT found some of these organisms in leeches. In a smear from the intestinal contents of a species of leech found in the drains of Taschkente the author found the vegetative forms—oval, pear-shaped, and rounded in appearance. The dimensions of the organism, nucleus, and its three flagella are given. Certain peculiar bodies believed to be Trichomonas cysts were also seen.

NOELLER (W.). **Blut- und Insektenflagellatenzüchtung auf Platten.** [The Plate Cultivation of Blood and Insect Flagellates.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1917. Feb. & Mar. Vol. 21. Nos. 4 & 5. pp. 53-94. With 3 text figs. & 1 coloured plate comprising 6 figs.

The medium used by Nöller for plate cultures was a slight modification of the ordinary N.N.N. medium and was made up as follows :—Agar 10, glucose 10, slightly alkaline horseflesh broth 1,000. This is distributed in tubes each containing 12 to 18 c.c. and sterilised by placing in a steamer on two successive occasions. This medium is melted in boiling water and poured from the tube into small glass vessels and thoroughly mixed with an equal quantity of sterile defibrinated horse blood. The mixture is then quickly poured into a sterile Petri dish, the lower dish being about 9 to 10 cm. in diameter by at least 2 cm. in height. The dishes are then immediately placed in an ice chest for the medium to set.

When inoculated the Petri dishes are inverted in the ordinary way and to prevent contamination the condensation liquid is caught in a 2 to 3 per cent. solution of sublimate which forms a layer 1 to 2 mm. in thickness in the cover. At room temperature the sublimate is renewed every two to three days, and at a higher temperature (28° to 33° C) daily, to compensate for evaporation.

The plates are inoculated with a small platinum loop. Impure seed material is diluted in broth, a drop placed on the middle of the plate, and spread evenly over its surface by means of a glass bulb. Pure cultures are transplanted by means of a soft sterile moistened camel hair brush. For serological tests young thick cultures are used in which degeneration forms have not appeared and material is lifted up carefully by means of a platinum loop in order to avoid admixture with any of the culture medium.

Seed material for the cultivation of insect flagellates is obtained by first examining aseptically small pieces of the insect intestine in sterile salt solution under a low power of the microscope in order to determine the presence of flagellates. The small pieces are repeatedly washed in sterile broth to get rid of most of the contaminating bacteria. A single small piece is then placed in a drop of broth on a sterile glass slide and covered with a sterile cover glass, which is moved to and fro in order to distribute the flagellates. By means of a small sterile syringe containing 1 to 2 c.c. of broth one then places a drop of broth at one end of the cover glass and sucks up the liquid at the other end. The contents of the syringe are well mixed and the process repeated several times until most of the flagellates have been drawn up into the syringe. A drop of the mixture is then spread over a plate and the platinum loop used to inoculate two or three more plates successively.

In order to separate impure cultures of flagellates from bacteria one makes use of the fact that the flagellates usually cling together in rosette-like clumps containing, as a rule, very small numbers of bacteria. The large cultivable flagellates also adhere very firmly to a glass slide. The material is thus placed in a large drop of sterile broth on a sterile glass slide and allowed to stand for 5 to 10 minutes. A small rosette-like clump then adheres so firmly to the slide that it can be washed with salt solution or broth several times without becoming detached. The clumps are then scraped off with a platinum loop and drawn up into a syringe containing about ½ c.c. sterile broth, shaken, and a drop used for inoculating one or several plates successively.

A second method used for the separation of flagellates, such as the sheep-louse Crithidia, which does not possess the same adhesive properties, consists in placing the impure culture in a drop of broth and carefully sucking up the large rosette-like clumps into a fine pipette. These are then mixed with another drop of broth, gently shaken, and again sucked up; the process is repeated until the clumps have been washed five to ten times.

Leptomonas fasciculata Novy, MacNeal, and Torrey, 1907.—This gnat Leptomonas, first described improperly by LÉGER, is important as it was the first insect flagellate cultivated (NOVY and collaborators, 1906) on plates and on account of the ease with which it is cultivated. Pure cultures have been kept alive by MESNIL even on ordinary agar. The author himself cultivated the parasite from the hind gut of two Culex females according to the method above described. The plates were kept in the dark in an incubator at from 22° to 26° C. In three days small dew-like colonies ·25 to ·5 mm. in diameter could be seen between the numerous bacterial colonies. Two days later the colonies reached from 2 to 3 mm. in diameter, were rounded, flat, and transparent. Later these colonies spread over the plate forming a dense mass of flagellates of a greyish-white colour. If this material is now transplanted on fresh plates discrete colonies are visible in one or two days and in from 6 to 10 days the growth spreads over the plate as a thick film. In plates from one to three days old the parasites show distinct nuclei and round compact karyosomes in process of division. In older cultures the flagellates are thinner and show a very indistinct nucleus with a minute karyosome.

Leptomonas ctenocephali Fantham. (= *Leptomonas pseudoleishmania* Brumpt).—Flea leptomonads are of great interest inasmuch as they were recognised by SANGIORGI and BASILE as stages in the development of the Mediterranean child Leishmania. The dog flea was thus supposed to transmit Leishmania from dog to man and from dog to dog. The author, however, in 1912, showed that this flagellate is very common in dog fleas in Leishmania-free districts (Berlin). DA SILVA, in Morocco, obtained negative results in transmission experiments with fleas that had fed on infected children. LAVERAN and his collaborators and FANTHAM and PORTER later claimed to have infected mammals with insect leptomonads; according to Nöller these writers failed to reproduce the pathological picture presented by a Leishmania infection and to demonstrate the viability of the Leishmania-like bodies said to have been found in the organs of the young animals supposed to have become infected.

WENYON (1913) first obtained a pure Leptomonas culture from the human flea and the organisms cultivated presented a striking resemblance to Leishmania. LAVERAN and FRANCHINI (1915) also obtained pure cultures of leptomonads from the mouse flea (*Ctenopsylla musculi*).

Nöller successfully cultivated leptomonads from the dog flea in the condensation water of glucose-horse-blood-agar tubes in 1914. The tubes were kept at a temperature of from 18° to 21° C.; development was very slow; only after from six weeks to three months did the flagellates produce turbidity in the condensation water. The cultures, however, showed marked viability inasmuch as motile flagellates were observed in the sealed tubes nearly two years afterwards.

In plate cultures growth was very slow at from 23°–25° C., but at 29° C. just visible colonies were observed in from 11 to 12 days. Pure sub-cultures kept at 28° C. show in about 14 days small round colonies up to ·5 mm. in diameter, which later coalesce but show scarcely any tendency to spread beyond the inoculated area. The growth on plates is thus much slower than that of *Leishmania donovani*.

A number of mice were inoculated intravenously with ½ c.c. of a milky emulsion of Leptomonas culture. A few died during the following month with enlarged spleens due to infection with *B. coli*. Nine weeks after inoculation the remaining mice were killed and cultures were made from the spleen and liver, with entirely negative results.

Leishmania donovani Laveran and Mesnil, 1903.—The Hamburg strain of *L. donovani* sown on the author's plates showed on keeping in the dark at 22° to 25° C. after 16 days a 4 to 5 mm. broad greyish-white film along the inoculation mark. On sub-culture on plates growth was seen in 7 to 10 days spreading from 1 to 2 mm. beyond the line of inoculation and later (in about 35 days) short stumpy outgrowths 1 to 3 mm. long by 0·3 to 0·5 mm. broad could be observed. A loopful spread evenly over a plate shows a uniformly thick film in from two to three weeks. Growth is apparently better in tubes of glucose-horse-blood-agar than in N.N.N. horse-blood-agar.

Crithidia melophagia Flu, 1908. (= *Crithidia melophagi* Swingle).—The sheep louse Crithidia were first cultivated by Wenyon, 1912, in the condensation water of N.N.N. rabbit-blood-agar. The author himself succeeded in 1916 in cultivating these flagellates from the anterior portion of the mid-gut of a sheep louse on glucose-horse-blood-agar tubes. Growth took place very slowly and between the colonies there appeared minute colonies of a coccobacillus similar to *Rickettsia prowazeki* found in the clothes louse and believed to be the cause of typhus in man. The name *Rickettsia melophagi* is given to this small organism which is apparently always found in large numbers in the intestinal tract of the sheep louse. It shows bi-polar staining when stained with Giemsa. In mixed cultures of this small organism and the Crithidia growth takes place very slowly in both cases; at 23° to 25° C. the Crithidia developed rather more quickly than the Rickettsia, but at 28° to 29° C. the Rickettsia grew slightly more quickly than the Crithidia. Macroscopic clumps of the Crithidia were found in the condensation water after two months. These were separated by the pipette method described above and sown on to plates kept at 29° C.; in 21 days small flat round transparent colonies 1 to 1·5 mm. in diameter could be seen between the just visible protruding Rickettsia colonies. Pure cultures were subsequently obtained. The sheep louse Crithidia undoubtedly resemble those blood parasites that are cultivated with difficulty. The best medium consists of glucose-horse-blood-agar in tubes.

The morphology of the organisms in culture is similar to that in the intestine of the sheep louse. The tendency to clump formation on the media is very apparent. The aspect of the very small culture forms and the difficulty with which they are cultivated precludes their identity with the cultural forms of the non-pathogenic cattle trypanosome *T. theileri*. If the theory of WOODCOCK and BEHN that the sheep louse Crithidia in England and Germany are stages in the development of sheep trypanosomes is correct then the latter organisms must differ from those of the *theileri* group. The author himself has had no opportunities of examining sheep trypanosomes.

Trypanosoma theileri Laveran, 1902.—The author demonstrated the identity of the flagellates cultivated from the gadfly *Tabanus glaucopis* and the ubiquitous cattle trypanosome in 1916 [see this *Bulletin*, Vol. 5, No. 1, p. 15].

The maintenance in the laboratory in a pure state of the forms then isolated led the author to devise his method of plate cultures. By this means pure cultures were obtained after five platings. The growth of the organism on plates is somewhat typical. In from five to seven days at 22° to 25° C. visible, rounded, dew-like transparent colonies ·5 mm. broad are seen. The colonies are later seen to throw out fine thread-like processes which again divide giving an appearance resembling that of a bark beetle. On moist plates the radiating processes grow two or more millimeters daily so that in a week's time, where there are numerous colonies, the plate seems covered with very fine threads. These threads are at first scarcely visible but later they become thicker, greyish-white in colour, and are clearly visible against the dark-red background.

During the first five to seven days long thin flagellated organisms are seen between which numerous dividing forms are found. The viability of the trypanosomes on plates is rather short. A few living forms were found in 47 day old plates kept at 22° C. Generally after from 7 to 10 days degeneration forms become very apparent, without flagella or undulating membranes and with numerous nuclei scattered throughout a single protoplasmic body.

Trypanosoma syrnii Mayer, 1911. (*Halteridium syrnii* Mayer, 1911).

The blood parasite from the wood screech owl, named as a Halteridium by its discoverer, grows easily in sub-cultures on plates. Stroke preparations kept at 22° to 25° C. show within seven days a number of parallel outgrowths 1 to 3 mm. broad and distant about 1 to 3 mm. from each other; these may attain a length of from 5 to 12 mm. and in 14 day old plates they may attain a length of up to 2·5 cm. The colonies are thus easily distinguishable macroscopically from those of the slowly growing cattle trypanosome from the gadfly. The colonies are of a greyish-white colour.

Trypanosoma rotatorium Mayer, 1843.—The commonly occurring and easily cultivable frog trypanosome was the object of a special study. The seed material was obtained from a well-nourished medium-sized water-frog showing a few rare trypanosomes in its blood. Blood was drawn from the abdominal vein and mixed with an equal quantity of citrate broth and sown on to plates kept at 22° to 25° C. In four days minute colonies were seen which in seven days attained a diameter of 1 mm. In from two to three weeks they attained a diameter of 3 to 5 mm., but their margins remained regularly rounded. Stroke sub-cultures showed in 14 days a thick greyish-white film with smooth rounded borders spreading 3 to 5 mm. outside the inoculation track. On very moist plates short stumpy outgrowths from 2 to 3 mm. in length and which easily coalesce may be observed. During the first three weeks the culture shows slender, actively motile forms with homogeneous cytoplasm, but from that time onwards degeneration forms appear to a gradually increasing extent.

A number of experiments detailed by the author showed that it was possible to infect water frogs in most cases with large doses of culture. MENDELEEF-GOLDBERG, on the other hand, obtained only negative results in such experiments, frog serum being stated to be highly trypanolytic. Nöller, however, showed that it was possible to obtain multiplication forms in frogs that had already been infected, death resulting within a fortnight in some cases. The trypanosomes were then numerous in the heart blood and very rich preparations were obtained from the kidneys. Long whip-like trypanosomes and short striped ones as well as phagocyted Leishmania-like bodies could be seen. It is recalled that THIROUX showed that the common trypanosome of the Java sparrow might produce marked pathogenic effects when inoculated in large doses. The grass-frog was found to be more resistent to infection than the water-frog. Inoculation gave negative results in the case of toads and goldfishes although an abortive infection was demonstrated in some of the latter animals.

A number of serological tests were made by the author with the frog trypanosomes grown on plates. The emulsion for the agglutination test was made in the ordinary way by taking up some clean culture in a platinum loop and diluting it with salt solution. A number of trypanosomes were found to be still alive in this solution after three days even when diluted 350 times. Blood was obtained from the frog by severing the hind leg at the stifle joint. The frog could be used for further experiment by tying the skin back over the cut surface again. The agglutination tubes were read off first after two hours and next after from 18 to 24 hours. The tubes were kept at room temperature (17° to 21° C.).

The horse serum used for making culture medium showed distinct agglutination in 1 in 20, and appreciable up to 1 in 80 dilutions. Fresh unheated horse serum was found to be extremely toxic for the trypanosomes. All forms were dead within an hour in undiluted serum. A 1 in 10 dilution was also very toxic and after standing a day careful search revealed extremely few motile forms. Serum heated to 56° C. had lost its toxicity, but agglutination was still appreciable in dilutions of up to 1 in 80.

With fresh guinea-pig serum agglutination was obtained only in dilutions of 1 in 10 up to 1 in 20, but, on the other hand, its toxicity was greater than that of the sera of normal grass-frogs and infected water-frogs. The trypanosomes all became immotile in dilutions of up to 1 in 20, but with weaker dilutions—1 in 160—a few rare trypanosomes were seen alive and these were always the long forms with homogeneous protoplasm. Inactivation caused the toxicity to disappear but the agglutination titer remained as before.

These results are not in keeping with those of M.-Goldberg, whose technique, according to the author, was faulty, in that she used the trypanosomes suspended in the liquid of condensation of the medium. The author showed that even when mixed with the undiluted serum of an infected water-frog complete destruction of the trypanosomes did not take place. A few long forms remained. The same results were obtained with tadpole blood. The serum of infected water-frogs showed distinct agglutination in dilutions of 1 in 40 and appreciable in 1 in 80. Undiluted serum killed off nearly all trypanosomes, but about 1 per cent. remained alive; a dilution of 1 in 10 killed about 90 per cent.; a distinct toxicity could be seen in up to 1 in 40 dilutions. Inactivated serum was non-toxic.

The serum of non-infected grass-frogs showed complete agglutination in 1 in 40 and distinct 1 in 80. Undiluted serum killed off almost all trypanosomes but a few remained alive as in the case of the infected water-frog.

It is noted that although the serum of the infected water-frogs showed a certain trypanocidal action the infectivity of the animal need not be diminished; normal human serum shows a high trypanocidal action on the virulent *T. rhodesiense.* The problem of trypanosome infection is extremely complicated. Many trypanosomes are known not to multiply chiefly in the blood but in the lymphatic system and other organs. It is only the pathogenic African trypanosomes and the nearly related organisms that act as pure blood parasites. No specific immunity could be detected in chronically infected water-frogs.

Schizotrypanum cruzi Chagas.—It was not possible to obtain a direct culture on plates from a laboratory infected mouse but growth was easily obtained at 29° C. in the water of condensation of horse-blood-agar tubes. The organisms were seen as Leishmania-like bodies devoid of flagella among which extremely few flagellated forms were seen. Later crithidial forms were found at the periphery of the clumps. Sub-culture on to plates was made from the water of condensation and at 33° C. there was soon seen small rounded colonies which coalesced and covered the inoculation track with a thick film in 10 days. Growth was slower at lower temperatures, and it may thus be said to be moderately slow. On plates one finds Leishmania-like forms and also a large number of typical crithidial forms.

DISEASES DUE TO METAZOAN PARASITES.

Commes (Ch.) & Devanelle (P.). **L'Onchocercose aortique bovine dans le Haut-Sénégal-Niger.** [Bovine Aortic Onchocerciasis in Upper Senegal and Nigeria.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 459–464. With 2 text figs.

In the course of a study of the human filariae of the above regions A. Leger (1912) noted that filarial embryos were also widely distributed in the blood streams of other animals, such as the calf, dog, hyena, and a number of birds.

The authors maintain that the ox is the animal most often affected. In the course of examinations of the left bronchial glands of slaughtered cattle they often cut through glandular-looking bodies from the size of a pea to a cherry containing yellow, caseous, distinctly calcified material. These movable nodules were found to be attached by means of connective tissue to the external coat of the aorta. Swellings of a similar nature were also found in direct contact with the blood vessel or still completely embedded in its external coat. Similar lesions could also be found on incision in the thickness of the wall and some of these on section disclosed simply a sort of transparent coagulated lymph. On the internal surface of the vessel wall there were also to be found cysts of about the size of a lentil filled with greenish-yellow matter. One could also note sometimes under the endothelium wavy channels protruding into the lumen of the vessel and filled with a brownish-yellow transparent clot; sometimes they were deeper and showed up clearly as greyish tracks against the opal-like whiteness of the endothelial coat.

These lesions were found on the main aorta, on about the first 30 cm. of the posterior aorta, and the first 10 cm. of the anterior aorta. The curvature of the posterior aorta was always the part most extensively affected.

All these lesions contained a nematode worm; the worms must thus have burrowed through the walls of the arteries adjacent to the heart and finally invade the periarterial connective tissue. For some reason the worm becomes at times encysted at some period in the course of its migration. 151 animals out of 198 systematically examined for these lesions, or 76·3 per cent. were found affected.

The classification of the parasite was undertaken by RAILLIET who showed that it was identical with *Onchocerca armillata* Raill. and Henry, 1909. The parasite was first described by LINGARD (1905) affecting the aortic wall of oxen and buffaloes in India, by TUCK (1907–1908) affecting oxen in the Malay States, and recognised by RAILLIET himself in 1902 in the aorta of a zebu from Sumatra. BERNARD and BAUCHE (1912) also found it in Annamese cattle. It has already been found on the African Continent by MASON, who attributed the aneurisms frequently occurring in Egyptian cattle and buffaloes to this parasite. Certain variations in the nature and position of the lesions have been noted by various authors. RAILLIET states that in his original description of the parasite (1912) the disposition of the genital papillae at the caudal extremity of the male was not accurately described as a number of them escaped his attention. He now states that the number appears to vary considerably in parasites from different regions so that it is impossible to fix a definite papillary formula.

DELANOË (P.). **Au sujet de l'existence dans le Cercle des Doukkala (Maroc Occidental) de la sangsue de cheval,** *Limnatis nilotica* **Savigny.** [The Horse-Leech in Western Morocco.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 458–459.

The horse leech is frequently found to infect wells in the Doukkala district in Western Morocco, and cases of respiratory distress in the human subject are not infrequently caused by drinking water from these wells. Horses are also very commonly affected in the same way. The author observed cases of pigs dead from asphyxia caused by this leech. The treatment employed by the natives consists in crushing up some onions together with tobacco and cautiously pouring the expressed liquid drop by drop into the nostrils and into the throat. This irritant mixture causes the animal to sneeze and cough violently and thus expel the leeches. The best way of ridding the wells of leeches is to breed eels in them.

MOUCHET (René). **Contribution à l'étude des Myiases.** [A Study of the Myiases.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 467–472. With 1 map.

In the country towards the western shores of Lake Tanganyika in the Belgian Congo the author studied a considerable number of cases of cutaneous myiasis affecting man and various animals. Nearly all the Europeans living in this region become infected with small cutaneous abscesses caused by a muscid larva. Under the name of "kiolo" this is well known to the natives as a parasite frequently infecting dogs. In one village situated at a fairly high altitude all the dogs were infected, small abscesses being found very commonly on the lower parts of their bodies.

On searching the native huts it was found that the rats and mice were almost constantly infected. Whereas, however, in the case of the dog a widespread infestation causes merely a transitory debility a fatal termination is often produced in the mouse and rat, or the abscess formation and gangrene may result, for example, in the loss of a limb. On the other hand, rats and mice caught outside in the open country among the brushwood showed no larvae and it thus appears that only those animals living inside houses become infected.

The parasite appears to be confined to the margins of the lake and can be found even in moderately high altitudes. The mouse and rat appear to be predilection hosts for the larva; in one village it was noted that the larva disappeared after a number of imported cats had exterminated these rodents. The Katanga Scientific Commission (1910–1912) was of opinion that the fly does not lay its eggs directly on the hosts but in the places where they habitually repose. This may account for the relatively greater incidence of infection in the rat and mouse than in the dog, which spends the greater part of its time outside the hut. Europeans become more readily infected than natives, probably because the fly finds a suitable place for laying its eggs in the bedclothes of the former whereas the native generally sleeps on dry reeds or hard boards.

The adult larva measures from 14 to 18 mm. in length and shows the general characters of muscid larvae. Attempts at cultivating the young larvae proved fruitless but the transformation of the adult larva was easily obtainable. When deposited on dry earth it became a pupa in from 24 to 28 hours and in from 10 to 16 days afterwards the fly emerged. In six series of experiments thus performed five gave rise to flies of the species *Cordylobia anthropophaga* Bl. and in the other experiment the species was *Sarcophaga haemorrhoidalis* Meig. = *nurus* Rdi. These two species of flies are very abundant inside houses.

A series of other muscid larvae have been found capable of causing myiasis in man and other animals in the Belgian Congo. The author himself studied in 1912 at Leopoldville on the head of an ox an extensive sore caused by the larvae of two species, viz., *Chrysomyia megacephala* Fabr., and *Lucilia sericata* Meig.

In 1914 at Tanganyika very serious ulcers involving the legs of goats were attributed to larvae of the species *Chrysomyia bezziana* Vill. = *megacephala* Fabr. Large oestrid larvae from 25 to 30 mm. in length are also frequently found in the nose and nasal sinuses of certain large antelopes, but breeding experiments with the larvae have given no results in these cases.

ROUBAUD (E.). **A propos de la communication de M. Mouchet "Contribution à l'Etude des Myiases."**—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 472–474.

In this criticism of the preceding article Roubaud states that the myiasis studied by MOUCHET was the ordinary African furunculous myiasis caused by *Cordylobia anthropophaga* Em. Blanchard. The larva was first discovered in Senegal in 1862 by COQUEREL and MONDIÈRE. The author has also shown that the larva of the fly described by DÖNITZ in 1905 under the name *Cordylobia murium*, which gave rise to a severe outbreak of disease among rats in German East Africa, was also identical with the above species. The natural infection of rats with this larva has been studied by DELANOË in the Ivory Coast. The larvae recently hatched out from the eggs may remain on the surface of the soil up to a fortnight at least awaiting the passage of a favourable host. The small larvae, which climb and are motile, then cling on to clothes and afterwards reach the skin. The eggs may also be hatched out directly on clothes, but infection cannot be produced directly in this way.

The second type of fly obtained by MOUCHET viz., *Sarcophaga nurus* Rdi., is not a specific causal agent of myiasis, but has a wide-spread distribution in various parts of the world. Infection by this larva must thus have been secondary to that of the first-named species.

Myiasis due to *Chrysomyia bezziana* Vill. is a specific myiasis of cattle in tropical Africa [see this *Bulletin*, Vol. 5, No. 1, p. 28].

ROUBAUD (E.). **Histoire d'un élevage de *Glossina morsitans* à l'Institut Pasteur de Paris.** [Breeding of *G. morsitans* at the Pasteur Institute, Paris.]—*Bull. Soc. Path. Exot.* 1917. July. Vol. 10. No. 7. pp. 629–640. With 2 figs. & 3 tables.

The brood of flies described by Roubaud originated from one surviving fertile female *morsitans* and two males brought back by him at the end of 1913 from Senegal. The brood was kept alive in the laboratory for more than three years.

Breeding took place in an incubator with an average temperature of 25° to 27° C. and 50 to 55 per cent. average humidity. A vessel containing water placed in the incubator produced the necessary humidity. Continual change of air was found to be indispensable for normal development. At one period the incubator temperature accidentally exceeded 32° C. and caused a mortality of 50 per cent.

among the pupae and the adults. LLOYD in Rhodesia observed that at 30° C. 49 per cent. of the pupae did not undergo further development. In the Nigerian Soudan the author bred *morsitans* at a temperature of 32° C., but this represented the average daily temperature established according to the maxima and minima.

Cages made of a metallic framework, 14 cm. by 8 cm. by 4·5 cm., covered with muslin of 1 mm. mesh served for breeding; 15 to 20 flies could be kept in one such cage. The flies were fed by applying the cage against the shaved abdomen of an animal. The larvae deposited in the cage made towards a corner to become transformed into pupae.

It was again demonstrated by the author that Glossina can be nourished on nothing else but blood. They could also be fed on citrated blood through a piece of chamois leather. The males and fertilised females during the laying period fed daily; the females, however, refused to bite the day before hatching a larva. Females not fertilised or not laying fed much less frequently, at intervals varying from one to seven days. The flies fed equally well on fowls as on guinea-pigs and rabbits. Although the incubator-bred flies appear to withstand the artificial conditions quite well and even attain in some cases a remarkable longevity the brood remained limited to about 20 flies per month. This is due to the short life and small productivity of the females and to the relatively large number of sterile pupae.

About two-thirds of the females did not live more than two months. Two flies showed an unusual longevity in that they lived for over five months. STUHLMANN, in the case of *G. brevipalpis*, observed a maximum lifetime of 3½ months. BOUET in Dahomey noted a maximum of four months for *G. palpalis*; KLEINE and FISCHER observed a similar duration (143 days).

Over a third of the pupae produced did not undergo further development. The large mortality among pupae bred artificially is most probably due to the bad conditions of deposition, the larvae often failing to find suitable places to become transformed into pupae.

Copulation takes place without any difficulty in the cages a few hours after the birth of the females. Larvae are hatched on an average from 15 to 20 days after copulation and pupae follow each other very regularly every 9 to 11 days. The majority of the larvae are laid between 5 and 6 p.m. In the Nigerian Soudan the author had noted that the *morsitans* laid every eight to nine days at 32° C. average daily temperature. KINGHORN in Rhodesia noted a great irregularity in the deposition of larvae of the same species and gives an interval of 14 to 15 days as normal for successive layings in laboratory conditions.

The majority of flies did not produce altogether more than five pupae each. Two, however, gave birth to 12 and one, in the course of a lifetime of 5½ months, produced the large number of 14 pupae. Some females were affected with sterility due to some unknown cause. The end of the brood was marked by considerable diminution in laying on the part of the females. The sterile females were found to have normal ripe eggs in the ovaries but these did not, however, descend into the uterus.

Changes of host for feeding purposes did not lead to more frequent laying. After the last laying the flies usually fed very irregularly.

The author never found the larvae of *G. morsitans* to produce a fluid secretion as described by LAMBORN and other observers.

The duration of pupation was on an average 30 days; the period was always longer for males than for the females. In the Nigerian Soudan the period was found to be from 23 to 28 days on account of the high average temperature (32° C.). LLOYD gives 21 to 25 days at 30° C., while KINGHORN noted a much longer period, 47 to 53 days, at laboratory temperature. NEWSTEAD gives 24–26 days as the duration of pupation in *morsitans* in Nyasaland.

With regard to the relative number of the sexes the author was able to confirm the views of other observers that the two sexes are equally numerous in artificially bred Glossina. The end of the brood was, however, marked by a characteristic preponderance in the number of males (out of 16 adult flies there were 15 males and 1 female, which did not survive). This sudden disappearance of females could not be accounted for and was the principal cause of the failure to carry on the breeding.

The author failed to infect his flies with *T. rhodesiense* and *T. brucei*, Uganda strain. Experiments were made in connection with the infection of pupae by means of a Chalcid parasite of muscids. The chalcid was found to lay its eggs in the pupa of *G. morsitans* as easily as in those of Calliphorina, the genus usually invaded. However, the individuals which develop inside the *morsitans* pupa cannot penetrate its thick covering and become liberated when they arrive at the adult stage. All the pupae bitten were killed, but none of the parasites emerged as they all died in the interior of the pupae. This experiment thus shows that it is impossible to employ these parasites for the destruction of *morsitans* pupae as proposed by AUSTEN.

YAKIMOFF (W. L.). **Les tiques des animaux domestiques du Turkestan russe.** [Ticks of the Domesticated Animals in Russian Turkestan.] —*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 298–301.

In the first part of this article a list of the various species of ticks identified by the author himself on domesticated animals in Russian Turkestan is given. The article is supplemented by tables showing the distribution of ticks in Russia, and for purposes of reference one of these tables is reproduced as follows :—

"*I.—List of genera and species of ticks found in Russia.*

"IXODINI.

"*Ixodaria.*

"Genus: *Ixodes* Latreille.

"*Ixodes arcticus* Herb. Osborn.—The Poibylevy Islands (according to NUTTALL).

"*I. arenicola* Eichw.—Borders of the Caspian Sea and Podolia (doubtful species; according to NEUMANN, probably *Hyalomma aegyptium*).

"*I. berlesei* Birula.—Borders of Angara (according to NEUMANN the description and figures are insufficient for identification).

"*I. cornuger* Kol.—Caucasus (doubtful species; according to NEUMANN, probably *Hyalomma syriacum*).

"*I. andyptidis* var. *singnatus* Birula. — Ungalaschka (Aleontian Islands).

"*I. hirsutus* Birula.—Ungalaschka, Eastern Siberia

"*I. reduvis* L.—Caucasus, government of Kieff, Kursk, Nijni-Novgorod, Riassan and north-west, and Finland.
"*I. spinocoxalis* Neumann.—Caucasus.
"*I. trianguliceps* Birula.—Borders of Lake Onega (doubtful species; according to NEUMANN, probably *I. tenuirostris*).

"*Rhipicephaloria.*

"Genus: *Rhipicephalus* C. L. Koch.
"*Rhipicephalus bursa* Can. and Franz.—Caucasus.
"*Rh. rossicus* Yakimoff and Kohl-Yakimoff.—Government of Saratow.
"*Rh. sanguineus* Latr.—Caucasus.
"*Rh. simus* Koch.—Turkestan.
"Genus: *Margaropus* Karsch.
"*Margaropus annulatus calcaratus* Birula.—Caucasus, Turkestan.
"Genus: *Hyalomma* C. L. Koch.
"*Hyalomma aegyptium* L.—Government of Astrachan, Kherson and Tschernomorsk, Caucasus, Siberia, Turkestan.
"*Hyalomma syriacum* Koch.—Caucasus Turkestan.

"*Amblyommataria.*

"Genus: *Aponomma* Neumann.
"*Aponomma crassipes* Neum.—Steppes of Kirghises (?)
"Genus: *Dermacentor* C. L. Koch.
"*Dermacentor reticulatus* Fabr.—Government of Kursk, Mohilev, Riasan, Saratow and Kherson, oblastes Primorsk, Caucasus, Siberia, borders of Amur, Turkestan.
"*Dermacentor variegatus* var. *kamschadalus*.—Kamchatka.
"Genus: *Haemaphysalis* C. L. Koch.
"*Haemaphysalis ambigua* Neum.—Caucasus (?)
"*H. concina concina* Koch.—Poland.
"*H. concina kochi* Neum.—Amur.
"*H. flava* Neum.—Caucasus.
"*H. leporis* Pack.—Caucasus.
"*H. neumanni* Dönitz.—Government of Primorsk.
"*H. papuana* Thorell.—Caucasus.
"*H. punctata* Can. and Franz.—Government of Kherson, Caucasus.

"ARGATINI.

"Genus: *Argas* Latreille.
"*Argas persicus* F.-W.—Government of Saratow, Caucasus, and Turkestan.
"*A. reflexus* Fabr.—Town of Odessa.
"Genus: *Ornithodoros* Koch.
"*Ornithodoros canestrini* Birula.—Caucasus.
"*O. tholozani* Lab. and Megn.—Caucasus.
"*O. talayae* Guér.—Borders of the Aral Lake."

SWEET (Georgina) & SEDDON (H. R.). **The Viability of *Melophagus ovinus* Linn., the Sheep Louse-Fly, Sheep Ked, or Sheep-"Tick."** —*Vet. Jl.* (*with Australian Supplement*). 1917. Apr. Vol. 73. No. 4. pp. 6–14. With 3 tables.

The only work recorded on this subject appears to consist of the rather crude experiments of CURTIS and SWINGLE. Both these authors found that the "tick" died off within four days when taken off the sheep. SWEET and SEDDON performed a number of small experiments with lots of 20 ticks each taken from unshorn sheep in November (Australian summer, weather wet and mild). In these experiments all the "ticks" were found dead, when kept in the conditions enumerated, within the following time limits:—moist grass in cellar 6¾ days; moist grass on lawn 5¾ days; dead leaves on soil on lawn 2¾ days;

dead leaves on soil in cellar 11¾ days; bare soil on lawn 2¾ days; bare soil in cellar 11 days; wool in laboratory 3¾ days; wool in cellar 4 days.

The authors draw up the following provisional conclusions :—

"A moderately cool uniform temperature is the most favourable condition for the persistence of the 'tick' off the sheep and without food, especially if it be dry.

"If extremes of temperature be present then moisture is necessary, dryness soon proving fatal.

"The life of 'ticks' in shed wool is short under uniform temperatures, whether cool or moderate.

"The state of nutrition does not seem to have influenced the viability of these 'ticks.'"

ADERS (W. M.). **Insects Injurious to Man and Stock in Zanzibar.**—*Bull. Entom. Res.* 1917. May. Vol. 7. Pt. 4. pp. 391–401.

Over a half of this paper is devoted to an enumeration and description of the gnats and mosquitoes of Zanzibar and Pemba Islands; seven species are described as occurring in Zanzibar town while 39 species were identified altogether on the islands.

Tabanidae are found in abundance in wooded areas close to streams and marshes in various districts in both islands. A few species were captured in open arid or grassy country. Their prevalence varies with the seasons and they are very abundant for about six weeks after the rains. Ideal weather conditions are slight showers of rain with intervals of sunshine. During heavy rain or high wind they may appear to be altogether absent. These flies have not been definitely proved to play a part in the spread of disease in Zanzibar but there is a certain amount of evidence that they are capable of acting as carriers of *T. pecorum*, the common trypanosome of stock in the island. Repeated efforts have been made to prove this experimentally but owing to the extreme difficulty of keeping these flies alive in captivity and inducing them to bite experimental animals, no positive results have yet been obtained. Seventeen species were altogether identified. The commonest tabanid is *Tabanus taeniola* P. de B. which often attacks man; when alighting on cattle it nearly always selects the lumbar region, seldom the legs, and becomes engorged in about 2½ to 3 minutes; in mixed herds of cattle and domesticated buffaloes the latter are always singled out for attack as they seem more callous to the bites. The small species, *T. par* Walk. has a wide distribution throughout the two islands; it nearly always feeds on the withers and hocks of cattle. *T. gratus* Lw. was observed in large numbers in various districts of both islands. *T. biguttatus* Wied., another common species, generally feeds on the hump of cattle seldom attacking any other part; engorgement in some cases takes 4½ minutes; males were taken on tree trunks in proximity to grazing grounds. *Aegophagomyia pungens* Aust. is a common species along the littoral of both islands and appears to be very little affected by high wind; on several occasions it was noticed feeding on goats. *Haematopota decora* Walk., the only species of this genus found, is very prevalent throughout the whole year and generally feeds on the hocks and withers of cattle, engorgement taking place in about 2½ minutes; this insect lives moderately well in captivity and has been used on many occasions in captivity experiments.

Chrysops longicornis Macq. is very common on both islands throughout the whole year; as many as 30 were captured in a few minutes on one donkey; its withers and hocks were smothered with them; once they have started feeding nothing disturbs them and they must be almost brushed off.

Muscidae.—The distribution of ten species is given. *Stomoxys calcitrans* L., occurs everywhere in the island where cattle are found. "Larvae have been found in recent moist droppings; manure pits swarm at all times of the year with larvae and pupae. Animals somewhat out of condition are especially singled out for attack, and this is a useful diagnostic sign when looking over a herd for a suspected trypanosome case. The following non-biting Muscids have been noticed feeding in association with *S. calcitrans*, licking the droplets of blood left from the Stomoxys puncture:—*Musca domestica, Pycnosoma putorium*, and *Biomyia tempestatum*."

Oestridae. "*Oestrus ovis* L. Large numbers of larvae have been taken from the frontal sinuses of goats; in some cases they had penetrated to the base of the horn, but they do not seem to cause any appreciable damage to their hosts. The pupal stage averages 19 days. Very common throughout the island. *Gastrophilus asininus* Br.—A few adults have been taken flying around cattle and donkeys."

One species of Drosophilidae and five of Hippoboscidae were identified. The number of Hippoboscids taken was surprisingly few and the author believes that a moist damp climate like that of Zanzibar is inimical to their development. *Hippobosca maculata* Leach, is common in cattle, horses, and donkeys; *Lynchia maura* Bigot., is common on domesticated pigeons.

Of fleas and lice, *Ctenocephalus canis* Curtis is found on dogs and large numbers have been taken from goats; *C. felis* Bouché, from goats; *Dermatophilus penetrans* L. is common and has been taken on two occasions from dogs; *Echidnophaga gallinacea* Westw., is very common on fowls especially on the bare parts of the head and around the eyes, while several specimens have also been taken from the common town rats. *Haematopinus tuberculatus* N. is common on domesticated buffaloes; *Liognathus vituli* L. was found on calves.

The following is a list of the ticks identified:—

"*Rhipicephalus appendiculatus*, Neum. The commonest species on cattle; undoubtedly the carrier of African coast fever.

"*Rhipicephalus simus*, Koch. Taken on cattle and donkeys.

"*Rhipicephalus sanguineus*, Latr. Very common on dogs.

"*Rhipicephalus evertsi*, Neum. Common on cattle, goats and sheep. Generally found around the anus or in the ears.

"*Rhipicephalus pulchellus*, Gerst. A rare form in Zanzibar. Numbers can be found on cattle imported from the Somali Coast, including replete females. This tick, probably owing to climatic conditions, has been unable to acclimatise itself on the Island; no specimens have been obtained from local stock.

"*Rhipicephalus maculatus*, Neum. From domesticated pig.

"*Boophilus decoloratus*, Koch. Abundant on cattle.

"*Boophilus australis*, Fuller. From local cattle.

"*Amblyomma variegatum*, F. Taken from cattle, goats, sheep and camels.

"*Amblyomma hebraeum*, Koch. A rare species; a few have been obtained from cattle.

"*Hyalomma aegyptium*, L. A number have been collected from camels; on other domesticated animals they seem to be rare. I am inclined to think that this species, like *R. pulchellus*, has been unable to acclimatise itself.

"*Haemaphysalis leachi*, Aud. Very common on dogs.

"*Haemaphysalis bispinosa*, Warb. From imported Indian cows."

BODKIN (G. E.) & CLEARE (L. D., Jnr.). **Notes on some Animal Parasites in British Guiana.**—*Bull. Entom. Res.* 1916. Oct. Vol. 7. Pt. 2. pp. 179–190. With 1 map & 3 text figs.

The following are among the more important of the species identified by the authors as affecting the domesticated animals:

"Nematoda.—*Filaria cervina*, Duj. A single specimen of this parasite was obtained from the abdominal cavity of a cow at the Georgetown Abattoir. It does not appear to be a common species.

"*Filaria immitis*, Leidy. It would probably be a difficult matter to find a creole dog over two years in age which does not harbour this parasite. Dogs about two years old generally possess at least one adult worm in the heart itself or in the pulmonary artery. In old dogs a thick tangled mass of the worms is often found in these organs, which would appear to choke them completely. However, the presence of this parasite seems to have but little effect on the general well-being of the dog. Imported dogs seem to thrive and are not rapidly killed by this worm as has been reported from China. The mosquito, *Culex fatigans*, Weid., is the probable vector of the disease.

"*Ascaris megalocephala*, Cloquet. One specimen of this large worm was obtained from a horse after the administration of a purgative.

"*Ankylostoma* sp. A common species, resembling *A. ceylanicum*, Loos, in the intestine of most dogs. As many as 15 of these worms have been taken from one dog.

"*Physaloptera ? praeputialis*, Linst. An exceedingly common parasite in the stomach of most cats. From 4 to 12 of these worms are usually found firmly attached to the stomach wall. Lutz has recorded the occurrence of this parasite in Brazil in the same host.

"Platyhelminthes.—*Dicorcelium* sp., near *D. lanceatum*, Stiles & Hassall. This parasite seems to be extremely prevalent among cats in the colony. At times the liver will be found to be very heavily infested, while in other cases only a few flukes will be found.

"Cestoda.—*Moniezia expansa*, Rud. This species was taken from a pig at the Georgetown Abattoir. It is not normally a parasite of the pig, but it is possible that in some manner or other the worm as excreted from its original host may have been consumed by this animal, as pigs are notorious eaters of all kinds of refuse and filth

"Acanthocephala.—*Echinorynchus gigas*, Goeze. This appears to be a common inhabitant of the small intestine of pigs in British Guiana; numerous specimens have, on various occasions, been obtained from pigs slaughtered at the Georgetown Abattoir.

"Acarina. Ixodidae.—In British Guiana all kinds of live-stock are attacked by various species of ticks, which are in many cases directly responsible for a very considerable annual financial loss. Preventive measures, such as dipping, are quite unheard of and the presence of these pests is universally regarded with the utmost indifference.

"*Argas persicus*, Wald. This tick is a common inhabitant of fowl-houses throughout the Colony, and the larvae are to be found on most varieties of poultry. The larval stage of this tick is known locally as 'Nimbles.'

"*Rhipicephalus sanguineus*, Latr. One of the commonest external parasites of dogs. All stages of development may be found on this animal. Between the digits and within the ears are favourite points of attachment.

"*Margaropus annulatus* var. *australis*, Fuller. Flourishes on all kinds of cattle. Steers that have been in the pastures for a few months soon become heavily infested and thereby lose weight and condition. Instances have been observed where several ticks have attached themselves to the eyelids and engorging there caused intense irritation. The death of a calf through tick infestation is not uncommon. The institution of properly constructed dipping or spraying contrivances would handsomely repay the initial outlay. This tick has a number of other hosts, including the common toad or "Crapaud" (*Bufo marinus*).

"Diptera. Tabanidae.—Within the coastal region the Tabanidae are of common occurrence, though they are chiefly composed of large numbers of a few common species. Within the forest areas, however, these coastland species seldom appear and their place is taken by numerous other species, some of which are comparatively rare. According to information received, the savannah lands near the Brazilian border are particularly rich in Tabanidae, but up to the present no opportunity has occurred for collecting or making definite observations within this area.

"The common species of Tabanidae that attack live-stock on the coastlands belong to the genus *Tabanus*—*T. trilineatus*, Latr., *T. senior*, Wlk., and *T. semisordidus*, Wlk.; of these *T. trilineatus* is possibly the commonest and most widely distributed.

"The numerous muddy trenches and ditches that are necessary for drainage purposes all over the coastal area, and more especially in the cultivated portions such as the sugar estates, provide very suitable breeding places for these flies, but very little is known of their life-histories; a wide and fascinating field for research is thus presented.

"A recent outbreak of Mal de Caderas (*Trypanosoma equinum*) amongst the sugar plantation mules was in all probability propagated by biting flies, and most of the common species of Tabanidae and other biting flies, such as the well-known *Stomoxys calcitrans*, L., were observed to feed freely on mules afflicted by this deadly equine disease.

"The principal enemies of Tabanidae are several species of the large predaceous wasps belonging to the Bembecinae. These, owing to their characteristic yellow and black coloration and fierce habits, have received the peculiar Creole name of 'Cowfly tiger.'

"Wherever Tabanidae occur, large numbers of these wasps will be observed to be active, especially round cattle and mules when in the pastures. Despite the loud buzzing flight and active darting movements of their enemies, the Tabanidae seldom display any concern at their presence, though they take good care to choose those portions of their host least exposed to the manoeuvres of the wasps. They are always more numerous on sandy soils, which provide greater facilities for their nesting habits. . . .

"Muscidae.—*Stomoxys calcitrans*, L. In all parts of the coastal area and in many of the inhabited areas of the inland regions this fly is of common occurrence. About stables in Georgetown, and particularly about the mule stables and compounds on the sugar estates, numbers of these flies are continually active, more especially in the early morning and evening hours. In the absence of other food supplies it will readily attack human beings and often proves most irritating. No decided increase in its numbers has been observed at any special season of the year.

"Hippoboscidae. A number of these flies are known to infest different kinds of birds and some mammals, but their activity, and the manner in which they quickly leave their host at its death, renders their capture extremely difficult.

"*Lynchia maura*, Bigot. Frequently found on domestic pigeons.

"Sarcopsyllidae.—*Dermatophilus penetrans*, L. This well-known species is widely distributed over the Colony. They are known locally as 'Jiggers' or 'Chigoes.'

"Pulicidae.—*Ctenocephalus felis*, Bouché. Probably the commonest species on the coast-lands. It is the common flea of domestic cats and dogs and occasionally attacks man.

"Haematopinidae.—*Haematopinus eurysternus*, Nitzsch. Collected from cattle on the coast-lands. It is the common cattle louse.

"*Haematopinus tuberculatus*, Nitzsch. This species was collected from imported Indian buffaloes, which apparently are the only hosts in British Guiana.

"*Haematopinus suis*, L. Very common on pigs. It was collected several times on these animals at the Georgetown Abattoir.

"Mallophaga. This order is well represented in British Guiana. From the economic standpoint the presence of ill-kept and overcrowded fowl-houses and pigeon-lofts and pens of a like character for sheep and goats accounts largely for the abundance of these parasites and for their wide distribution among domestic animals.

"Some species of birds in the wild state appear to be heavily infested with lice, while others again are almost entirely exempt.

"*Trichodectes pilosus*, Gieb. On donkey (*Equus asinus*).

"*Trichodectes climax*, N. On goat (*Capra hircus*).

"*Trichodectes sphaerocephalum*, N. On sheep (*Ovis aries*)."

Various species of other families of Mallophaga affecting several kinds of birds and the guinea-pig are then given.

EPIZOOTIC LYMPHANGITIS.

CHATELAIN (P.). **Considérations générales sur le traitement de la lymphangite épizootique.**—*Rev. Gén. Méd. Vét.* 1917. July 15. Vol. 26. No. 307. pp. 289–293.

In this preliminary note the author first discusses some of the characteristics presented by the disease according to his observations in Morocco. In order that the disease may assume an acute form two factors are necessary: (1) a warm country, (2) a damp climate. In Morocco the disease occurs in a particularly serious form along the coast, whereas in elevated districts at some distance away it is less severe and often becomes cured spontaneously. Flies abound in the hot, humid districts throughout the year and, after a case of epizootic lymphangitis has been observed, it is not rare to find the disease appearing after 20 to 60 days in horses bearing harness wounds and not brought into contact with the affected animals.

Potassium iodide gave no good results in the author's hands but caused the animals treated to become extremely restive. Biniodide of mercury gave only partial success. "606" likewise failed to give the expected results. Treatment by means of iodine and methylene blue employed after dilaceration of the tissues in early or localised cases gave excellent results. In the elevated districts this treatment cured all the affected animals. 350 cases were treated at a hot and damp centre near the coast with 86·2 per cent. recoveries in from 30 to 40 days, 11·1 per cent. in from 40 to 110 days, while 2 per cent. were slaughtered on account of generalisation. 85 per cent. of these cases were brought in from districts along the coast and 15 per cent. from elevated districts. The same treatment employed at Casablanca failed to give the same results; VELU, who tried other treatments especially with novarsenobenzol, in the same conditions, failed to get the expected results.

In France the iodine-methylene blue treatment was applied in the Somme region and gave good results. The author claims that typical epizootic lymphangitis can be distinguished clinically in that the hair becomes shed at a spot and then a bud develops raising the skin, which becomes brilliant in appearance. A bud resembles a black grape with the dust wiped off and bursts spontaneously two or three days afterwards discharging a yellowish, granular pus from a crater-like ulcer with raised and thickened borders. In the so-called ulcerative lymphangitis the buds are generally situated on a limb, often causing lameness. They are developed underneath the skin and are only revealed on palpation. The hair does not fall from their surface. After two or three days the abscess spontaneously bursts discharging a yellowish, sticky, often sanguinolent pus; the abscess becomes rapidly closed if treated with antiseptics but almost immediately it has cicatrised a new abscess develops a short distance away. The animal is lame when the buds form in the neighbourhood of a joint.

The author records a couple of cases of ulcerative lymphangitis successfully treated by means of the iodine-methylene blue method.

The author thus recommends that every horse not reacting to mallein and showing a number of multiple abscesses developing in echelon on a limb should receive two injections of 10 cc. of 1% methylene blue intra-muscularly at three days' interval. A cure is obtained in a few days without any local treatment except washing with weak antiseptic solutions such as tincture of iodine.

TRUCHE & GUIGNARD. **Contribution à l'étude de la lymphangite épizootique.**—*Bull. Soc. Cent. Méd. Vét.* 1917. Jan. 4. *Rec. Méd. Vét.* 1917. Jan. 30–Feb. 28. Vol. 92. Nos. 3 & 4. pp. 64–68.

In this short article the authors describe a series of eleven observations on the treatment of epizootic lymphangitis occurring in horses which had been cast from the French army in France. Various products recommended by French authors were tried, viz., luargol, potassium iodide, novarsenobenzol, and galyl. The use of galyl by DOUVILLE in the treatment of this disease has already been referred to in this *Bulletin* [Vol. 4, No. 3, pp. 111]; out of five cases treated exclusively with this drug four recovered completely and one showed considerable progress. The cryptococcus was demonstrated in each case. The authors' conclusions are as follows:—

Epizootic lymphangitis is amenable to treatment by means of galyl.

Small doses, even frequently repeated, and large doses given at too long intervals did not give appreciable results; it is preferable to inject at once at least three grammes on the first two occasions at intervals of a week. The tolerance of animals for this product being very great there is no harm in giving frequent doses.

If a cure is not obtained after the first two injections one may recommence the treatment with 2 or 3 grammes without any danger.

PERRIN. **Notes sur la détermination de la période d'incubation de la lymphangite épizootique en France.** [Length of the Incubation Period of Epizootic Lymphangitis in France.]—*Bull. Soc. Cent. Méd. Vét.* 1917. May 3. *Rec. Méd. Vét.* 1917. Apr. 30–May 30. Vol. 92. Nos. 9 & 10. pp. 191–194.

In a unit comprised of artillery horses in France the author had under his observation five cases which at different times contracted injuries affecting various parts of the body. These injuries healed after a few days but subsequent to healing swollen lymphatics were found to originate from the seats of the former injuries; the lesions thus set up were found to be due to epizootic lymphangitis. The length of time these lesions of epizootic lymphangitis took to develop after the healing of the wound would represent the minimum period of incubation, while the length of time from the infliction of the injury would correspond with the maximum period. For the five horses the maximum periods were thus, respectively, 127 days, with possible error below 15 days; 111 days, error below 24 days; 115 days, error below 15 days; 120 days, error below 7 days; 120 days, error below 15 days. This gives 118 days as the average maximum incubation period, which would be 15 days in excess of the minimum.

CHARMOY. **Sur la lymphangite épizootique.**—*Rec. Méd. Vét.* 1917. Apr. 15–May 15. Vol. 93. Nos. 7 & 8. pp. 179–196. With 5 figs. & 1 table.

The greater part of this paper is devoted to the symptomatology and lesions of the above disease, chiefly as they occur in army horses at the front in France. The disease is stated to be a common affection in certain of the French colonies (Algeria, Morocco and Senegal), but, before the war, it was almost unknown in France. It made its appearance among horses at the front towards the end of the year 1914 and from being rare and localised at that date it has now become so common and widespread that it constitutes a veritable danger for the cavalry.

The author had under his own observation a few interesting cases of generalisation and of lesions on the more rarely affected parts. Cases are thus depicted affecting the skin above and below the lips and closely resembling horse-pox lesions, lesions on the pituitary mucous membrane, and around the vulva. In one case on post-mortem a specific ulcer was found on the internal surface of the cricoid cartilage of the larynx. In two cases lesions of chronic endocarditis were found on the mitral valve of the left heart in the form of fibrous nodules about the size of peas, together with patches of endarteritis; these lesions, however, were not specific but in the nature of complications. No lesions were discovered in the lungs although in many cases purulent centres were discoverable in the pulmonary parenchyma, but these never revealed the presence of cryptococci.

With regard to treatment the author's experience has led him to adopt the surgical method wherever practicable. Various drugs recommended by different authors were tried but gave inconstant results. The ideal local treatment is stated to consist in the extirpation of all the affected parts and in the case of small lesions this method gives perfect results. When it was not possible to employ this radical method of treatment he attempted to sterilise the purulent centres by cauterisation, by the application of chemical agents, or by a combination of these two methods. In every such case the horse is cast and securely bound, a heated sharp-pointed cautery is then introduced into each abscess or into the opening of each ulcer; every protruding lymphatic is explored in the same way and it is then always found to reveal pus in its depth. The borders and depth of these lesions are well cauterised and the point of the instrument pushed as far forwards as possible within the interior of the lymphatic vessel. Excessive granulations are excised by means of the flat cautery.

With the aid of the ordinary cautery, or better by means of the auto-cautery, the author next inserts a series of fine points about 1 cm. from each other all round the affected part. This circle is circumscribed by a double or triple circle of punctures in order to prevent extension. A blister is then applied all over the cauterised surface. There is no risk attached to this no matter how extensive the surface treated. On the following few days there is an enormous reaction, then towards the 6th day or 7th day the reaction diminishes. The affected part is then treated by the application of antiseptics such as saturated alcoholic picric acid or methylene blue. If fresh abscesses appear they are punctured by means of the pointed cautery. The author gives in a table a list of 48 animals treated as above; 29 were cured after a period varying from 20 days to 3 months, 8 were destroyed on account of the severity of the lesions and of the remaining 11 all, with the exception of 1, were gradually progressing towards recovery.

BRINGARD. **Un traitement de la lymphangite épizootique.**—*Bull. Soc. Cent. Méd. Vét.* 1917. June 7. *Rec. Méd. Vét.* 1917. June 30. Vol. 92. No. 12. pp. 216–224.

In this article the author describes a method of treatment adopted by him with successful results over thirty years ago in Algeria. His observations led him to conclude that the appropriate treatment consisted in the surgical extirpation of the swollen lymphatic vessel or its destruction by means of some procedure acting directly on the interior of its lumen. The drugs employed failed to give satisfactory results. The removal of the lymphatics by means of a bistoury is attended with grave risks on account of the damage done to the surrounding tissues, and of secondary infection.

The instruments thus used by the author consisted of iron rods about 18 inches long and about the thickness of a lead pencil provided with a wooden handle at one end. These rods heated white hot served to cauterise the whole of the interior of the lymphatic. The operation is easily performed; the horse is cast so as to expose the affected lymphatics. If the lymphatic is no more than about 9 inches long one excises the bud on the side away from the lymphatic gland and then inserts the heated rod into the exposed orifice and passes it along the interior of the channel up towards the centre of the lymphatic gland. When the affected lymphatic is longer the process is repeated two or three times by passing the rod each time from a distal bud to another situated more centrally. The rods may be curved in order to follow tortuous lymphatics. Cases where the buds are not connected by means of apparent lymphatics are inoperable by this method, but such cases are very rare, and do not exceed 5 per cent. During the first week after the operation an abundant suppuration takes place leading to the shedding of the cord and glandular congestion.

A 10 per cent. solution of tincture of iodine is afterwards injected into the channel. It is claimed that cures can be affected in four to five weeks in cases of horses refractory to all other methods of treatment.

Details are given of eight cases occurring in the French army; on these the author had the opportunity of again testing his method of treatment. The results again proved its efficacy as all the horses were cured in a comparatively short time.

FINZI (Guido). **Les composés du mercure dans le traitement de la lymphangite épizootique.** [Treatment of Epizootic Lymphangitis by means of Mercurial Compounds.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 428–430.

Five seriously affected cases were successfully treated by the injection at short intervals of the following mercurial compounds:—6 per cent.

salicylate or 5 per cent. calomel in liquid paraffin intramuscularly, 1 per cent. perchloride or benzoate combined with cacodylic acid in watery solution, subcutaneously or intramuscularly. From ten to twelve injections of doses varying from 5 to 40 c.c. repeated in each case every two or three days were required to produce complete recovery.

FAVERO (F.). **L'arsenivan nella cura del farcino criptococcico.** [Treatment of Epizootic Lymphangitis by means of Arsenivan.] —*Moderno Zooiatro. Parte Sci.* 1917. June 30. Vol. 6. No. 6. pp. 129–136.

In this short article the author gives a review of the literature dealing with the treatment of epizootic lymphangitis and records observations of ten cases of the disease occurring in Italy. These were treated by means of an Italian arsenical preparation—arsenivan—prepared at Parma University. Cures were obtained in all cases in from 11 to 30 days. The drug was well tolerated when administered by the digestive tract or intravenously, but produced moderately severe reactions when injected subcutaneously.

VELU. **Le traitement curatif de la lymphangite épizootique par la vaccinothérapie.** [Vaccine Treatment of Epizootic Lymphangitis.]—*Bull. Soc. Cent. Méd. Vét.* 1917. May 3. *Rec. Méd. Vét.* 1917. Apr. 30–May 30. Vol. 92. Nos. 9 & 10. pp. 195–204.

The vaccine is made up as follows:—Pus withdrawn aseptically is emulsified with 10 times its bulk of normal saline solution to which is added 0·25 per cent. carbolic acid and about 0·14 per cent. ether. The mixture is then filtered through several thicknesses of sterile open-wove gauze.

Subcutaneous inoculation of a suitable dose of this mixture sets up quickly a reaction manifested by very distinct clinical symptoms. A negative phase is first observed in which all the symptoms become aggravated—suppuration increases, the larger buds ripen and sometimes open, the affected lymphatics become more swollen and tender. This phase lasts three or four days, sometimes five or six. Its intensity varies with the dose of vaccine employed.

This phase then changes rather quickly—in 24 or 48 hours. The swelling around the lymphatics diminishes and buds appear which were not visible before the injection. Healing of ulcers is accelerated; secretions from open abscesses and large sores diminish to such an extent that local treatment is almost unnecessary. This positive phase lasts on an average from four to five days but it may vary from no time up to ten days; the disease then resumes its normal course. A repeated injection causes the same cycle of phenomena to appear but if it is performed before the end of the positive phase the negative phase following is somewhat delayed and it is less intense and does not last so long as in the case of the first injection.

The problem in the treatment of epizootic lymphangitis by means of vaccine therapy thus resolves itself into the determination of suitable doses and the intervals after which they should be renewed in order to set up mild negative phases and well marked positive phases. Velu, who has had very considerable experience with the disease in

Morocco, gives a record of eight seriously affected cases in which this treatment was carefully carried out. He considers that the record justifies the expectation of good results. The vaccines failed in each case where the affected animal was so weak in condition that it was unable to react. " A cure is thus not assured in every case but a great advance is made on the treatment of the disease by means of drugs and on the local treatment consisting in the application of antiseptics or excision of the lesions." Recovery was produced in the cases described within six weeks.

As the result of his experience Velu recommends the injection of 2½ c.c. of the vaccine and then allowing an interval of seven or eight days to elapse. If there is persistent aggravation of the symptoms the dose injected was too strong and a few days should elapse before injecting a smaller dose. If there is no change the dose injected was too weak, and a larger dose should be injected immediately. If there is distinct progress the dose is sufficient and should be renewed or slightly increased or decreased, according to the reaction which one desires to set up. A cure can be obtained in this way after 30 to 40 days.

BACTERIAL DISEASES.

TRUCHE (C.). **Traitement bactériothérapique de la lymphangite ulcéreuse.** [Vaccine Treatment of Ulcerative Lymphangitis.]—*Ann. Inst. Pasteur.* 1917. May. Vol. 31. No. 5. pp. 209–214.

The above disease has apparently assumed a very serious character among army horses in France; the author claims to have obtained distinctly satisfactory results in treatment by the use of dead cultures of the organism isolated from the lesions, viz., the Preisz-Nocard bacillus.

M. NICOLLE, LOISEAU and FORGEOT observed a very high specific antitoxic power in the serum of infected animals. This was equal to or even higher than that of horses immunised by CARRÉ by means of filtrate. These authors, however, showed that the serum of affected animals was devoid of anti-bacterial properties.

Cultures were obtained by growing the organism, maintained in the laboratory on solid serum, on potato agar in Roux flasks incubated for 24 hours at 37° C. The bacterial growth is twice washed by emulsifying in salt solution and centrifugation. The bacteria are then killed by adding equal quantities of alcohol and ether and allowing to stand for 24 hours. The overlying liquid is then poured off and the bacteria dried at 37° C. The vaccine is prepared for use by emulsifying the powder in normal salt solution, 1 centigramme per 1 c.c., and distributing in ampoules which are heated to 100° C. for four or five minutes.

The dose of vaccine is 1 centigramme inoculated every week under the skin of the neck. A small swelling forms at the seat of inoculation. " One may see the buds shrink, suppuration dry up, and the cords disappear after the second injection, but recovery usually takes place after the third." A number of figures are given showing the results of this treatment. In one lot, out of 43 animals treated, after the third injection 14 were completely cured, 23 were in various stages of recovery, while the remainder died from various causes or were killed on account of debility.

[This mode of treatment is not new. Dead cultures were used by MONTGOMERY in British East Africa for the treatment of a cutaneous disease of equines from which the Preisz-Nocard bacillus was isolated (see this *Bulletin*, Vol. 5, No. 1, pp. 64).

We cannot see the force of using the alcohol-ether mixture " in order to eliminate the life (that is to say, the virulence) of the germs without changing their antigenic qualities, etc.," if before injection they are heated to 100° C. for five minutes, and still maintain the desired properties.—ED.]

TRAWIŃSKI (Alfred). **Ueber das Vorkommen von Bakterien der Typhus-Coligruppe im Darminhalt gesunder Schweine, zugleich ein Beitrag zur Differenzierung der Bakterien der engen Paratyphus B.-Gruppe.** [Bacteria of the Typho-Coli Group in the Intestinal Contents of Healthy Pigs; Differentiation of the Bacteria of the Small Paratyphoid B. Group.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1917. Jan. 10. Vol. 83. No. 1. pp. 117–176. With 24 tables & 6 text figs.

The question as to whether bacteria of the paratyphoid B. group can be found in the intestines of healthy pigs has already been investigated by several authors (DORSET, UHLENHUTH, and others). The material used by the author for ascertaining the presence of these bacteria was obtained from the contents of the jejeunum, colon, and caecum of apparently healthy pigs which had been brought in for slaughter to the abattoirs from places free from disease and kept under observation for about 10 days before slaughter. The suspected colonies obtained on sowing out this material underwent a long series of searching laboratory examinations.

The author's conclusions are as follows :—

(1) From the intestinal contents of 500 healthy slaughtered pigs were grown 26 strains (5·2 per cent.) which from the appearance of the colonies, biological characters, agglutination tests, and partly according to their pathogenicity fell into three groups.

(a) Two strains belonged to the small paratyphoid B. group and were identical with *B. suipestifer* from the appearance of the colonies and partly also from the results of agglutination tests and pathogenicity towards white mice.

(b) Eight strains which formed a uniform type of colony differed in their biological characters from representatives of the small paratyphoid B. group only in so far as that they did not ferment sorbite ; serologically they showed an affinity towards *B. aertryk* (de Nobele) and partly also towards *B. suipestifer*. 62.5 per cent. of these strains were pathogenic for white mice. They formed indol and should be classed with the paratyphoid-like strains.

(c) Sixteen strains possessed a common type of colony and differed biologically from representatives of the small paratyphoid B. group in that they did not ferment dulcite and sorbite. They were agglutinable with the anti-sera of representatives of the small paratyphoid B. group. Their own anti-serum agglutinates the strains of this group very highly but has no influence on representatives of the small paratyphoid B. group ; the strains of the second group were partly agglutinated and partly not influenced. In all the strains a positive indol reaction was obtained ; 12·5 per cent. were pathogenic for white mice. They were recognised as pseudo-paratyphoid strains.

(The strains belonging to the second and third group could not be placed in the system of classification of the typho-coli group according to Weber and Haendel or Gildemeister and Baerthlein, for they did not completely correspond culturally with *B. paratyphosus* B.)

(2) The representatives of the small paratyphoid B. group (*B. paratyphoid* B., *B. aertryk* de Nobele, *B. suipestifer*, *B. typhomurium*, and *B. psittacosis* Nocard) cannot be sharply distinguished from each other by means of their morphological, biological, and serological (agglutination, Castellani's test) properties, nor according to their pathogenicity, but that differentiation is possible is shown by the results obtained from examining the types of colonies.

HARDENBERGH (J. B.) & BOERNER (Fred Jr.). **Vaccinations against Hemorrhagic Septicemia, No. 2.**—*Jl. Amer. Vet. Med. Assoc.* 1917. Mar. Vol. 50. (New Series. Vol. 3.) No. 7. pp. 868–876. With 2 tables.

In a previous report the authors published an account of work carried out by them for the Pennsylvania State Live Stock Sanitary Board for the year 1915. Vaccination during that period was carried out by means of living 48 hour broth cultures of *Bacillus bovisepticus* isolated from outbreaks of haemorrhagic septicaemia. No special measures were taken to attenuate the organism as experience had shown that no method of attenuation was capable of producing strains that would furnish uniform results. The only test to which the inoculation material thus complied was that it should be virulent for rabbits and guinea-pigs but not for sheep and calves. The use of living vaccines would ordinarily appear to give far better results than the use of killed or modified vaccines as the latter most probably lose their antigenic properties to a considerable extent. One of the drawbacks in connection with the use of living vaccines, however, lies in the fact that centres of infection may be established, but the experience gained in 1915 showed that no fresh cases occurred during the following year among the vaccinated herds.

Vaccination was carried out in the same manner during the year 1916 in a total of 31 herds. The first 11 vaccinated herds, termed "exposed" herds, contained steers that had passed through public stockyards, become infected, and been taken to the farms and mixed up with the native cattle. These herds contained altogether 265 animals; six deaths occurred prior to vaccination, and 24 animals were sick at the time of vaccination. With the exception of one sick animal all were vaccinated; only one death afterwards occurred in the herds.

The remainder consisted of native herds in the mountainous districts of Pennsylvania in which the disease appeared during the months of June to October; there were 53 deaths before vaccination and 19 sick at the time of vaccination. Twenty deaths occurred following the treatment.

During the two years 1915 and 1916, 25 native sick animals at pasture were vaccinated and of these 13 succumbed to the disease. In 1916, 22 out of 23 sick vaccinated steers recovered; these were suffering from the chronic pulmonary form of the disease and had been exposed to infection in stock yards. This chronic form of the disease is seldom seen on pasture, the acute form being observed instead. The authors conclude that the vaccine may have some therapeutic value in chronic cases.

The complete absence of haemorrhagic septicaemia in 1916 in the herds vaccinated in 1915 might indicate that considerable immunity had been conferred on the animals; however, the absence of the disease also from a number of control herds left unvaccinated and kept under observation during 1916 invalidates such a deduction.

The authors propose to carry on further experiments in this connection.

MOHLER (J. R.). **American Veterinary Medical Association. Report of Committee on Diseases.**—*Jl. Amer. Vet. Med. Assoc.* 1917. Mar. Vol. 50. (New Series. Vol. 3.) No. 7. pp. 895–904.

The information regarding the following three diseases is extracted from the above report.

Haemorrhagic septicaemia. (Stock-yard fever, shipping fever, contagious pneumonia).—An unusually large number of cases of this disease occurred during the autumn of 1915 and spring of 1916. The disease appeared among cattle in public stock markets or in shipments that had been recently handled through public stock yards and it was believed that the infection was picked up in the stock yards or from the trucks in which the animals were transported. Frequently native cattle became infected within a week after coming in contact with other animals that had contracted the disease from stock-yard exposure. In some instances native cattle appeared to become infected after the recent admission of cattle from stock-yards, although no visible symptoms of the disease could be detected in the latter animals. Examination of the lesions showed that the disease was caused by *Bacillus bovisepticus.* In several instances infected cattle transmitted the disease to sheep upon the farms into which they were brought and in one instance a colt which was running with diseased sheep became infected. The disease has been recognised in the United States for the past 20 years; a few outbreaks have occurred every year, but the losses were unusually large during the past year and the application of quarantine measures is contemplated in some States in order to prevent further outbreaks. All cattle are susceptible but young animals are more susceptible than adults. Cows in which the vitality has been lowered by heavy milking and exposure by standing in yards during cold and stormy weather proved very susceptible. The most serious outbreaks occurred among store cattle in poor condition, especially if kept in a crowded shed for some time prior to sale. Examination of carcases at abattoirs often showed lesions of haemorrhagic septicaemia in cattle which were kept for 7 to 10 days in pens prior to being sold, whereas no lesions could be found in cattle slaughtered within three or four days after entering the yards.

The loss from the disease ranges from 2 to 20 per cent. of the herd although the mortality among affected animals is from 70 to 90 per cent. The mortality is not alarming in view of the large number of cattle that pass through the public stock-yards of the country, although in several instances losses from death were reported amounting to 50 per cent. of a herd. Vaccination by means of so-called " bacterins or dead bacterial products has been adopted but as the outbreaks in untreated herds usually terminate abruptly with losses varying from

2 to 20 per cent. the value of the preventive treatment is not definitely known." . . .

"*Dourine.* Dourine in horses has increased somewhat in prevalence in certain states during the past year. This condition is due to the spread of the disease among the horse stock of the Indian reservations and to the inability of the Bureau of Animal Industry to prosecute vigorously the work of inspection and eradication at the round-up season because of lack of funds. Of 45,100 samples of blood serum tested by complement fixation by the Bureau during the fiscal year ending June 30, 1916, 1,400 gave positive reactions. This is 3·1 per cent, as compared with 2·7 per cent for the preceding fiscal year. The infected states are Montana, Wyoming, North Dakota, South Dakota, Nebraska, and Arizona. Notwithstanding the difficulties, good results have been accomplished in the work of eradication.

"*Swamp Fever* [Infectious Anaemia of Equines]. That swamp fever is of increasing economic importance is evidenced by the fact that it has gained a foothold in New York, where it was not recognised prior to 1914. That the diagnosis should have been confused with 'other septicemic diseases,' suggests that there may be still other localities where swamp fever may be present without having been recognised. Within the last 10 days this disease has been reported from Louisiana where it was causing considerable losses on at least one plantation.

"Unfortunately continued experiments in sero-diagnosis have thus far failed to yield a satisfactory diagnostic procedure. Likewise experiments in insect transmission of this infection have been entirely negative. A recent experiment has shown that an animal in good condition and without showing any outward appearance which would arouse suspicion, may retain the virus of swamp fever in the blood even after 6 years. The blood of this animal when inoculated into another horse produced swamp fever in 13 days. The former animal therefore furnished a source of infection for insects during 6 years, but during this time no spontaneous cases developed, even though healthy horses were kept in the same stable without protection against insects. During this time both *Tabanus* and *Stomoxys* flies have been present, as well as many other species of insects."

DISEASES DUE TO FILTERABLE VIRUSES.

MORI (Nello). **Rabbia e Setticemia emorragica in alcuni bufalotti.** [Rabies and Haemorrhagic Septicaemia in some Young Buffaloes.] —*Ann. Staz. Sperim. per le Malat. Infet. d. Best.* Naples. 1915. Vol. 3. No. 1. pp. 55–80.

A disease showing symptoms affecting almost exclusively the nervous system had caused the death of four young sucking buffaloes on a farm where there was no history of a previous occurrence of such a disease. About a month previously two dogs had presented clinical signs of rabies in this neighbourhood and had been destroyed. The heads of two of the calves were sent to the author for examination. No histological changes were seen in the brain.

In one case sub-dural inoculation of rabbits produced slight symptoms of intoxication immediately afterwards from which they recovered but died of paralytic symptoms about a fortnight afterwards. Inoculations by passage of brain material from these rabbits definitely demonstrated the presence of rabies virus in the brain.

In the case of the second calf inoculation of brain substance subdurally into rabbits produced violent symptoms of intoxication affecting the nervous system immediately after inoculation from which the animals died within five hours. No organism was cultivable from the blood or any of the viscera of the rabbits. These symptoms were also produced by the inoculation of the filtrate obtained by passing an emulsion of brain substance through a Berkefeld filter.

The brain of the first calf kept on an ice chest for three days, then emulsified and passed through a Berkefeld filter was also capable of setting up similar symptoms but to a far less degree.

Microscopic and cultural examination of the brains of both the young buffaloes revealed the presence of small numbers of a Pasteurella organism identical in appearance and cultural characters with *B. bubalisepticus*, the cause of "barbone," or buffalo plague. Inoculation and feeding experiments showed that the organism isolated manufactured in liquid cultures a very powerful toxin capable of setting up marked nervous symptoms in rabbits, guinea-pigs, dogs, and young buffaloes.

These experiments appear to show that the symptoms shown by the naturally affected calves, although resembling those of furious rabies in bovines, were not attributable to the rabies virus since they could be reproduced experimentally by the inoculation of a toxin contained in the brain of buffaloes, rabbits, or set up by means of a culture of the organism isolated from the brain. By its association with the rabies virus in milk-fed young buffaloes *B. bubalisepticus* appears to have undergone a great increase in virulence. The dams were more resistent as all contract "barbone" while young and this seems to confer a lifelong immunity.

REMLINGER (P.). **La rage spasmodique du cobaye.** [Spasmodic Rabies in the Guinea-Pig.]—*C. R. Soc. Biol.* 1917. June 16. Vol. 80. No. 12. pp. 590–592.

When the guinea-pig is inoculated with rabies virus into the anterior chamber of the eye it shows a special form of rabies which is interesting on account of the analogy of the symptoms with those produced in human rabies. Whether the eye remains intact or becomes shrunk up, as is very often the case even when the inoculation is carefully carried out, the disease commences with an intense local reaction in every way comparable with the reaction produced in the scars of bites in human beings. This reaction is manifested both by objective and subjective symptoms. Lachrymation occurs, the conjunctiva becomes congested and suppurates, the eyelids become red and swollen, and the lesions become the seat of an intense pruritus; the animal scratches them furiously with its paw or rubs its head on the same side as the inoculated eye against the walls of its cage. Almost at the same time the animal attracts attention by a sort of sonorous, coarse, thick gurgling noise comparable to the croaking guttural of certain frogs. It can be easily seen that this particular noise takes place in the pharynx and is connected with difficulty in swallowing set up by a spasm of this organ. The pharyngeal spasm appears to correspond exactly with the hydrophobic spasm in human rabies.

At the same time the animal presents a dejected appearance, erect hair, and dyspnoea. It remains motionless in its cage and if forced to move its gait betrays a certain degree of paresis.

Its condition soon becomes aggravated and violent convulsive crises are produced. These commence with the above described guttural noise; then instead of remaining localised the pharyngeal spasm becomes generalised throughout the body. The animal then bends itself round on the ground and emits feeble plaintive cries. After a few seconds it gets up on its feet and remains still until further convulsions are produced. A moderate sensory stimulus such as contact with water, sharp noise, sudden tapping, touching of the inoculated eye, etc., bring about instantaneously the reappearance of these symptoms. These crises finally become almost continuous until the animal is unable to get up and respiration gradually ceases. The total duration of visible disease rarely exceeds 48 hours, and is never longer than three or four days.

The author proposes to designate this particular form of rabies under the name of "spasmodic rabies."

REMLINGER (P.). **Le virus rabique dans ses passages de cobaye à cobaye.** [Changes Undergone by the Rabies Virus in the Course of Transmission from Guinea-Pig to Guinea-Pig.]—*C. R. Soc. Biol.* 1917. June 30. Vol. 80. No. 13. pp. 628–630.

The rabies virus attains its maximum virulence more quickly in guinea-pigs than in rabbits; after a small number of passages—seven or eight—one obtains a virus capable of producing rabies symptoms after five or six days and which, when inoculated into the dog, exceeds in virulence the natural disease in that animal.

The symptomatology of rabies in the guinea-pig is liable to vary according to a number of factors, the chief of which are the seat of inoculation, age of the animal, nature and dose of virus. Other things being equal the first intracranial passages, starting from the dog's medulla, set up most often the paralytic form of rabies.

After a very small number of passages (one to four) it is on the contrary the furious form which is seen in its most exalted form. The guinea-pig stands with hairs erect, blows hard, has a fiery look, runs about its cage biting the other occupants, passes its head through the grating at the risk of choking itself, "chuckling," scattering its food about, etc. Soon the animal becomes still more agitated, shows great genital excitement, falls on its side, then gets up, and goes on again but soon it tires itself out and assumes a staggering gait. Finally, it remains stretched out affected with intense dyspnoea, gives a few sudden jerks with its limbs and body, but these become gradually weaker, while respiratory movements gradually cease. Death then very soon supervenes.

If the inoculation is made in the anterior chamber of the eye the "spasmodic rabies" is produced characterised by an intense reaction both objective (congestion, lachrymation) and subjective (pruritus) at the point of inoculation, pharyngeal gurglings, and spasms and more or less violent convulsive crises. . . .

However, from the seventh to the fifteenth passage the acuteness of the symptoms becomes lessened and the course of the disease can no longer be termed furious. There is no restlessness and the chief symptom is dyspnoea, the symptomatology closely resembling that of the numerous pulmonary affections which very often occur in guinea-pigs. At other times even dyspnoea is very slight and the guinea-pig is found in the morning dejected and lying still in a corner of its cage with erect hair, no appetite, and regardless of its surroundings. In the evening it lies on its side, tossing its body and limbs, and soon succumbs; the symptoms are more analogous to those of a septicaemia than of a broncho-pneumonia.

At the same time the length of the incubation period and of the visible disease is so shortened that death occurs very regularly from the fifth to the seventh day. Sometimes even it is produced so rapidly during the night of the fifth or sixth day or during the course of the fifth day that it appears to have taken place suddenly, as there was no time to observe any marked symptom. These are the so-called fulminating forms of rabies; no lesion is shown in the organs, cultures from the blood and viscera remain sterile, and a positive result is only obtained by passages. In the course of experiments with rabies every guinea-pig which dies without characteristic symptoms, or is found dead with no symptom, should be held as suspicious. Negri bodies should be looked for and the medulla inoculated.

From about the twelfth to the twenty-fifth passage paralytic phenomena become superimposed on the above symptoms. In the course of the later passages they assume an increasing importance and then no matter how many times the virus is transmitted from guinea-pig to guinea-pig it is from the exclusively paralytic forms that the animals succumb. While the rabies following inoculation into the muscles of a limb commences generally with a paralysis involving contraction of the inoculated limb (tetanic type) the paralytic rabies observed as the result of passages through the brain and anterior chamber of the eye is of the flaccid type. This takes place nearly always on the sixth day, rarely on the fifth, and exceptionally on the seventh. Paralytic phenomena appear to be produced sooner when the original virus is obtained from a dog dead of paralytic rabies than of furious rabies. Large doses of virus and inoculation of young animals also predispose towards the paralytic forms.

SANI (Luigo). **Sul passaggio del virus rabido attraverso la mucosa oculo-congiuntivale sana e traumatizzata.** [The Passage of Rabies Virus through the Healthy and Injured Oculo-Conjunctival Mucous Membrane.]—*Ann. d'Igiene.* 1917. Jan. 31. Vol. 27. No. 1. pp. 16–22.

The author's experiments, which were performed with fixed viruses for the rabbit and for the guinea-pig, showed that it was possible to reproduce rabies experimentally by passage of the virus through the oculo-conjunctival mucous membrane only when the virus had a markedly exalted virulence for the species of animal selected for experiment; the disease could in such cases be set up whether the mucous membrane was macroscopically healthy or contained recent artificially produced lesions. Cases of rabies are, however, rare even after instillation of an emulsion of an exalted virus into the conjunctival sac.

The instillation of virus that had not been exalted did not produce rabies. The author believes like former writers that the rarity of the cases thus produced is due not to a neutralisation of the virus in situ but to the abundant lachrymation immediately produced after the instillation.

According to his experiments the lesions present on the mucous membrane are of secondary importance in the production of experimental rabies. One must thus admit from these experiments that in the case of injury of the mucous membrane the minute quantities of virus that pass through become neutralised along the course of the ramifications of the nerve fibres.

FERMI (Claudio). **Il nuovo metodo italiano per la cura antirabbica.** [The New Italian Method of Anti-Rabic Treatment.]—*Ann. d'Igiene.* 1916. Vol. 26. Supplement. 164 pp.

The method of rabies vaccination evolved by Fermi at Sassari, Sardinia, is briefly as follows.

The vaccine consists of a 5 per cent. emulsion of a potent fixed virus, carbolised 1 per cent., direct from the rabbit or dog. The brain instead of the cord is used as the former was shown to be more active. The anti-rabic serum is obtained by hyperimmunising horses, using the above vaccine as antigen. The sero-vaccine consists of 1 part of serum and 2 of vaccine, carbolised 1 per cent. The method of treatment consists in the administration of sero-vaccine for the first 5 to 10 days followed by the injection of the vaccine alone up to the 25th day. The mortality from rabies following this treatment was calculated to be lower than that following treatment according to the methods employed by HÖGYES, BERNSTEIN, and REMLINGER. Advantages claimed for the vaccine and sero-vaccine are that they can be preserved for long periods sterile and potent in sealed tubes, can be transported over any distance for use, do not inconvenience the patient, and set up an immunity immediately in the case of severely bitten patients.

The new Italian method is stated to have been substituted in British India for a number of years for the Pasteur and Högyes methods on account of the superior results obtained.

MARTOGLIO (F.). **Sui corpuscoli speciali osservati da Braddon nel sangue di animali infetti di peste bovina e ritenuti probabilmente specifici.** [The Peculiar Bodies observed by Braddon in the Blood of Animals infected with Rinderpest and claimed to be Probably Specific.]—*Ann. d'Igiene.* 1917. Apr. 30. Vol. 27. No. 4. pp. 246–250.

In 1913 BRADDON published a paper in which he maintained that by the addition of a solution containing 1 per cent. potassium citrate and 0·5 per cent. methylene blue in different proportions to rinderpest-infected blood peculiar slender bodies of varying shapes could be always demonstrated within the red corpuscles [see this *Bulletin*, Vol. 2, No. 1, pp. 45–47]. Martoglio had at his disposal a number of bovines affected with rinderpest at the Serum Institute at Eritrea and experiments were carried out using the technique recommended by BRADDON in order to ascertain whether the above bodies could be detected.

It was found that out of 30 bovines affected with rinderpest, blood taken three days after the onset of fever or six days after infection presented none of the forms claimed to have been rendered visible by BRADDON in all cases of the disease under the form of granules and filaments in the interior of the red corpuscles and with sharp or rounded extremities, etc. It thus seemed that BRADDON'S bodies had no connection with the rinderpest virus. The filamentous forms which he observed in fresh preparations did not appear to represent a morphological stage of the virus since they were revealed in the blood of healthy bovines afterwards shown to be perfectly susceptible and also in the blood of an animal not receptive, and in a horse. The author believes that the bodies represent degenerative changes in the corpuscles brought about by the treatment to which they are subjected.

GINS (H. A.). **Ueber experimentelle Vaccine und Vaccineimmunität.** [Experimental Vaccinia and Vaccinia Immunity].—*Zeitschr. f. Hyg. u. Infektionskr.* 1916. Aug. 18. Vol. 82. No. 1. pp. 89–142. With 2 tables.

This paper is an account of work, undertaken by order of the German Minister of the Interior, on the question of cow-pox immunity and a full discussion of the work already done on the subject is included. The animals used for the experiments were exclusively rabbits, as these animals were found to be most convenient and furnished the best results. In all 173 rabbits were inoculated with virulent material, for the most part by scarification of the cornea and some also by scarification of the skin.

The following are the author's conclusions :—

"The spontaneous appearance of vaccine pustules was never observed in rabbits and therefore the single pustules which always result could be dealt with experimentally.

"Rabbits inoculated with virulent material over a large skin surface always showed swelling of the precrural lymphatic glands and almost always enlargement of the spleen.

"Experiments performed in order to bring about multiplication of the vaccine virus on the ordinary artificial media always ended in failure.

"An infected cornea, cultivated in plasma according to the Harrison-Carrel method preserved the virus remarkably well. The newly formed tissue in the plasma showed cell inclusions which were not distinguishable from vaccinia corpuscles.

"Bacteriological tests of a considerable number of glycerinated lymphs never revealed the presence of pathogenic bacteria. The number of organisms diminishes so rapidly by preserving in glycerin that only a very few single germs gain access to the scarification marks in the vaccination of children.

"The cornea of the rabbit does not hold a special position of its own with regard to vaccine immunity. The cornea takes part in the general immunity to a slight degree whether the rabbit is inoculated into the skin or whether the rabbit is immunised by intravenous injection. A marked infection of the cornea can lead to immunity throughout the whole body.

"The immunity of the cornea follows considerably later than that of the skin after cutaneous or intravenous inoculation.

"Vaccine immunity in the rabbit is not a pure histogenic immunity as van Prowazek regarded it. The blood stream must be regarded as carrier of the immune bodies.

"The anti-virulent substances described by earlier workers are specific reaction products following on vaccine infection. They appear so regularly and abundantly and are durable for so long a period after infection that they must be held to demonstrate an acquired active immunity."

GINS (H. A.) & WEBER (R.). **Ueber den Nachweis des in die Blutbahn eingespritzten Vaccinevirus in inneren Organen bei Kaninchen.** [The Fate of Cow-Pox Virus injected into the Blood Stream in the Internal Organs of the Rabbit.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1916. Aug. 18. Vol. 82. No. 1. pp. 143–154. With 2 tables.

Conclusions :—" With regard to the presumed fate of the vaccine virus injected intravenously the following conclusions are laid down as the result of our experiments :—

" The fact that the virus disappears very quickly from the blood stream was also confirmed in all our tests.

" By means of the test of Calmette and Guerin the virus can be demonstrated in the skin in very small quantities and by no means constantly." (This test consists in injecting a rabbit intravenously with virus ; if the skin is shaved at any time up to 24 hours after injection pustules appear on the shaved area.)

" This virus owes its survival apparently to the fact that it gained access into the blood vessels of the skin immediately after inoculation and thereby escaped rapid destruction in the animal body.

" After intravenous injection of large quantities of virus the virus can be demonstrated in the spleen in varying large quantities if this organ is used for inoculation within the first five hours after the injection.

" The virus was never demonstrable in the bone marrow ; and, in the liver it was found once only in small quantities after the injection of 50 c.c. of lymph diluted 20 times and once in considerable quantity in an animal after excision of the spleen.

" The spleen of rabbits inoculated into the skin was found to contain virus in only one case."

MARTEL (H.). **Rapport sur les opérations du Service Vétérinaire Sanitaire de Paris et du Département de la Seine pendant l'Année 1915.** pp. 146. 1916. Paris: Grande Imprimerie "Le Papier." [Myocardite aphteuse. (Myocarditis and Foot-and-Mouth Disease.)] p. 146.

" In the course of outbreaks of foot-and-mouth disease cases of sudden death observed among cattle are generally attributed to an acute form of the disease affecting the nervous system. Examination of a carcase in 1915, during the January outbreak, shows that death may occur otherwise.

" A cow in good condition was slaughtered. There were pronounced foot-and-mouth disease lesions in the process of healing on the tongue, ulcers of the same nature around and between the claws of the hind legs, and complicated ulcers due to infection with soiled litter.

" The infection of the sores on the hind legs manifested itself by a marked reticular lymphangitis of the fetlocks and by an inflammation of the lymphatic vessels extending upwards to the external iliac glands, which were swollen and haemorrhagic. The heart, which was not enlarged, presented an abnormal colour showing an irregularly marbled appearance due to light interposed areas. On incision the heart wall was found to be the seat of an intense myocarditis. Several soft haemorrhagic centres were distributed throughout the tissue in such a way that the myocardium might become perforated at any moment, with fatal results."

COSCO (Giuseppe) & AGUZZI (Angelo). **Sulla virulenza del sangue dei bovini aftosi e prove d'immunizzazione contro l'afta epizootica.** [The Virulence of the Blood of Bovines affected with Foot-and-Mouth Disease and Experiments on Immunisation against this Disease.]—*Direzione Generale della Sanità Pubblica.* 12 pp. 1917. Roma : Stabilimento tipografico Innocenzo Artero.

This pamphlet is issued by the Italian Public Health Administration by whose direction a series of experiments are being conducted by various workers under the control of a special Commission.

In a previous note Cosco and Aguzzi referred briefly to the results of their experiments which demonstrated in particular the virulence of the blood during the febrile period in foot-and-mouth disease [see this *Bulletin*, Vol. 4, No. 2, pp. 62].

After natural or artificial infection a rise of temperature follows after a period of incubation varying with the mode of infection and virulence of the infective material. If highly virulent material from fresh lesions is rubbed on to the scarified buccal mucous membrane the incubation period may be limited to 24 hours or even less; ordinarily it is from two to five days. After subcutaneous inoculation with highly virulent red corpuscles (2nd or 3rd passage) the incubation period lasts about 70 hours, but never less, while with corpuscles of lesser virulence it lasts on an average from five to nine days; inoculation with virulent blood serum gives practically the same results.

The fever is of the remittent type and is preceded for about an hour by other symptoms, such as rigors and loss of appetite. The rise in temperature then reaches about 2° C. The febrile crises follow each other every 24 hours with great regularity and in the intervals the temperature may drop from 1° to 2° C.

Eruptions rarely occur during the first crisis; they are usually observed during the second and not rarely during the third or even the fourth crisis. In the more severe forms, especially after inoculation by scarification, the eruptions appear sooner while on the other hand following inoculation with virulent red corpuscles it is not rare to observe even the initial eruptions during the fourth febrile crisis. In all cases the eruptions do not occur simultaneously, that is, they do not all develop during a single crisis.

In the majority of cases the red corpuscles were found to possess their maximum virulence at the beginning of the second and third crisis, and to become less virulent during the ascent of the febrile curve; the virulence diminishes at the height, and disappears completely or almost completely during the descent of the curve. The serum on the other hand appears to attain its maximum virulence during the height of the crisis and unlike the corpuscles never appears to lose its virulence completely.

Experiments performed in order to determine the virulence of the red corpuscles and of the serum showed that with equal doses the latter is always more powerful. It might appear that the corpuscles owe their virulence to a small quantity of serum remaining cemented to their bodies after centrifugation,—but, (1) if the corpuscles are washed by repeated centrifugation their virulence remains unchanged, (2) it is impossible to produce the disease by the inoculation of less than ¼ c.c. of serum, (3) if the corpuscles and the serum are kept separately in an ice chest the virulence of the serum disappears several days before that of the corpuscles; the serum becomes inactive after remaining in these conditions for 24 days while the corpuscles were shown to be virulent even after 32 days.

With regard to minimum doses required to produce the disease by subcutaneous inoculation, repeated tests showed that in the case of the corpuscles obtained from blood extracted at a favourable moment during the development of the fever in cattle affected with the natural disease the dose, shown to be the optimum, was 10 c.c. When an outbreak has assumed a serious character one can, however, obtain blood containing corpuscles capable of producing the disease in much smaller doses. In the case of an exalted virus obtained by passages through the bodies of susceptible animals it is not difficult to set up the disease by the inoculation of 1 c.c. of corpuscles. The serum when extracted from the blood at a favourable moment during the febrile curve is capable of setting up the disease with a minimum dose of ¼ c.c.

Bovines were used exclusively in connection with experiments for the exaltation of the virus. Passage through swine gives rather better results but as the experiments were performed with the object of providing material for the immunisation of cattle the use of heterologous products presented disadvantages. Commencing with the inoculation of 10 c.c., subcutaneously, of corpuscles from a bovine infected by scarification it was found possible to increase the virulence in the course of six passages so that (1) finally, severe foot-and-mouth disease was set up by the inoculation of 1 c.c., (2) by continuing to inject a constant dose of 10 c.c. a more severe form of the disease was set up each time than in the preceding passage until at last the animals died from the apoplectic form, and (3) the incubation period became shortened from an average of 6 days to 70 hours.

The administration by ingestion of large quantities of infective material such as the products from the vesicles in the mouth and blood (40 c.c. corpuscles and 20 c.c. serum) invariably gave negative results.

Intravenous inoculation gave the following results, care being taken to prevent the escape of material subcutaneously :—(1) In the case of the serum small quantities—¼ c.c.—constantly set up foot-and-mouth disease in the same way as subcutaneous inoculation; (2) the inoculation of red corpuscles even in such a high dose as 35 c.c. never set up the visible disease, whereas 10 c.c. of the same corpuscles inoculated subcutaneously into controls set up symptoms similar to those manifested in the animals from which the blood was originally obtained.

Immunisation tests.—While occupied in controlling the method of immunisation proposed by Terni [see this *Bulletin*, Vol. 4, No. 4, pp. 173], the authors made use of the materials at their disposal in an attempt to discover a vaccine against foot-and-mouth disease. Several experiments were performed, chiefly in the direction of preparing a sensitised vaccine according to Besredka's method; material from the buccal lesions was thus collected and subjected to the action of serum from immune bovines. The material obtained became always so badly contaminated that it was impossible to produce an effective vaccine in this way.

The red corpuscles, however, inasmuch as they could be withdrawn aseptically and possessed a slight virulence, which had hitherto escaped the notice of other authors, proved invaluable for experiments on immunisation. Attempts to sensitise the virus contained in them by Besredka's method proved unsuccessful as no satisfactory method could be devised for keeping the corpuscles intact. The method of vaccination thus consisted in setting up an active immunity by the intravenous injection of virulent corpuscles.

The material necessary for vaccination was not difficult to prepare, easily preserved, and easily administered in practice. As shown above large doses of virulent corpuscles can be inoculated intravenously without setting up external manifestations, but the injection determines a general reaction represented by a rise of temperature which is manifested almost immediately after inoculation, lasts about 24 hours, and reaches about 2° C. above normal; this is accompanied by other symptoms such as depression, increase in respiration, inappetence, and slight disturbance in connection with the gastro-intestinal tract. Animals thus inoculated intravenously were subsequently inoculated subcutaneously with virulent corpuscles, simultaneously with a number of controls, which each received 10 c.c. of the corpuscles, of the same breed and condition. Sixteen cattle vaccinated by means of a single intravenous inoculation were exposed at various intervals during six months to natural infection, and, with the exception of one case, none of these animals developed lesions, whereas all the controls became affected.

The authors conclude that washed corpuscles after intravenous inoculation are capable of setting up a slight general reaction without external lesions and that this initial injection, according to their preliminary experiments, is capable of setting up an immunity which lasts at least two months.

[A very full extract is given above on account of the high administrative authority under which the note is published; the results, however, appear to be so widely different from those of other observers that they must necessarily be read with reserve until the authors issue for criticism full details of their experiments.—ED.]

MISCELLANEOUS.

(a) CONTAGIOUS PUSTULAR STOMATITIS.

DE JONG (D. A). **Le rapport entre le stomatite pustuleuse contagieuse du cheval, la variole équine (Horse-Pox de Jenner) et la vaccine (Cow-Pox de Jenner).** [The Relationship between Equine Contagious Pustular Stomatitis, Equine Variola (Jenner's Horse Pox) and Vaccinia (Jenner's Cow Pox).]—*Folia Microbiologica.* 1916. Nov. 1. Vol. 4. No. 3. pp. 239–266. With 5 plates comprising 14 figs.

This article opens with a very complete and critical review of the equine affections described variously under one or other of the above names from the time when JENNER (1800) attributed the origin of cow-pox to an affection involving the heels of horses and described simply by him under the name of "grease." Although the disease has been recognised to have been of comparatively common occurrence in England and its occurrence on the Continent often attributed to the importation of English horses very little has been written about it in this country since the time of JENNER. In France, on the other hand, the disease has engaged the attention of various observers and, according to NOCARD and LECLAINCHE, BOULEY (1860) would be the first to suggest the name "horse-pox" for outbreaks of a pustular nature among equines. Since CHAUVEAU'S work on variola (1886) it has been held in France that the equine variola, which had been considered up to then as a so-called spontaneous disease, could manifest itself under the form of a vesiculo-pustular eruption not only on the limbs but also on several other parts of the skin and even on the mucous membranes.

In Germany, on the other hand, even comparatively modern authors (EGGELING and ELLENBERGER, FRIEDBERGER, and DICKERHOFF), considered equine variola either as a rare disease or even denied its existence; they maintain, however, that there is a commonly occurring affection of horses known as "contagious pustular stomatitis" to which French authors had given, wrongly according to them, the name of "horse-pox." A so-called "contagious acne" of horses is likewise recognised.

In Holland outbreaks of cow-pox have been definitely known to occur at intervals for over a century, and, according to the author, the disease known as "contagious pustular stomatitis" of the horse is well known to Dutch veterinary surgeons although no accurate figures can be given.

Soon after the mobilisation of the Dutch army at the commencement of the present European war outbreaks of pustular stomatitis occurred in various garrisons stationed near The Hague. Diagnosis was quite easy. Besides stomatitis there were often seen pustules on the skin of the head and other parts of the body as well as at the extremities of the limbs.

The following are briefly the symptoms manifested in one outbreak affecting 300 requisitioned horses. The first symptom consisted in marked salivation, especially during feeding, but the appetite was not diminished although the horses ate with difficulty. A multitude of small papules are found at this stage on the mucous membrane of the lips, especially the upper lip, occupying the site of the follicles; there is a small amount of fever, then small vesicles filled with a clear liquid appear, especially on the upper lip, occupying the sites of gland follicles. The submaxillary lymphatic glands may then become congested.

The second stage is seen in one or two days. The contents of the vesicles become turbid giving rise to pustules. The epithelium is then shed leaving small cavities from the size of a large pin's head to that of a small pea. These small ulcers often become confluent and give rise to irregularly-shaped excavations. These changes are seen on the insides of the lips, on the gums above the incisor teeth, and on the tongue. The lesions cause very excessive salivation and often a foetid odour from the mouth and swelling of the lips. The excoriations then heal and in about 10 days every trace of eruption has disappeared from the lips. The tongue lesions heal rather more slowly.

In some animals besides eruptions there are seen swellings on the skin. Two horses showed a large number of papules on the neck, shoulders, chest and fore legs. One of these animals presented during this second stage a cutaneous eruption in the form of local thickenings on the chest and fore legs; these burst, became confluent and formed a sort of granulating surface. Four horses showed a continuous inflammation in the hollow of the heels of the fore and hind limbs. The swellings were first observed, then the hairs became moist and finally the heel became scabby. Under the scabs were found small rounded granulating ulcers similar to those found on the lip but not confluent. No lesions were found on the mucous membranes other than those of the mouth.

The period of incubation may last from four to six days, the virulence is greatest at the commencement of an outbreak, and it was at this period that the largest number of cutaneous eruptions were observed. Later on, these eruptions became rarer, and also the excoriations on the tongue. Even the eruptions on the skin and mucous membrane of the lips became less serious and one might observe sometimes healing by absorption without rupture of the pustules. Transmission of the disease by means of the saliva appears to be most frequent.

The diagnosis is easy although at the beginning one may be dealing with normal or diseased follicles. However, the glandular congestion and the contagious nature of the disease prevent error.

Treatment shows no difficulty as the affected animals recover spontaneously.

Experimental.—In this connection the author performed numerous experiments on the transmission of contagious pustular stomatitis of horses to healthy horses and also to calves, rabbits, and children, both with fresh exudate and exudate after filtration through a porcelain filter. Some transmission experiments with cow-pox lymph were also made. The following are the author's own conclusions :—

"(1) In the cases observed of contagious pustular stomatitis of the horse an eruption was found in the mouth and on the skin.

"(2) The material collected from the mouth of affected animals was capable of transmitting experimentally the disease including the cutaneous eruptions.

"(3) The same material passed through Chamberland B. and F. filters retained the same infectivity.

"(4) Vaccinia cultivated in the ordinary manner was equally capable of producing in the horse the pustular stomatitis including the cutaneous eruptions.

"*The horse which had contracted spontaneously the stomatitis was refractory to inoculation with vaccinia.*

"(5) Two different strains of virus of contagious pustular stomatitis of the horse behaved like vaccinia in the course of inoculations into the calf and the rabbit ; in the latter animal also the corpuscles of Guarnieri were obtained in the inoculated cornea. Besides, the deviation of the complement test furnished still further corroborative proof of this contention.

"(6) The vaccine obtained by inoculation of virus of contagious pustular stomatitis of the horse could be cultivated regularly on animals as easily as the ordinary vaccine. This vaccine of equine origin gave excellent vaccinal pustules in the case of children inoculated with it.

"*The re-vaccinated children showed only a re-vaccination reaction.*

"(7) Rabbits inoculated with ordinary vaccinia and which had shown a strongly positive reaction, after recovery and re-vaccination with the stomatitis virus, manifested only an early allergic reaction (von Pirquet) ; on the other hand controls showed a characteristic eruption.

"(8) We have proved that the contagious pustular stomatitis of the horse is actually the most common form of Jenner's horse-pox and that the virus of this stomatitis passes through Chamberland B. and F. candles. This fact was hitherto unknown."

GREGG (James). **Vesicular Stomatitis Contagiosa.**—*Vet. Record.* 1917. Mar. 17. Vol. 29. No. 1497. pp. 381–382.

This preliminary note deals with the occurrence and etiology of a disease affecting horses and mules at the British Remount Depot, Newport News, Virginia, U.S.A.

The clinical nature of the disease is passed over briefly. It is merely stated that the mouth lesions resembled those of foot-and-mouth disease, but that there were no lesions about the feet. 85 per cent. of horses, 75 per cent. of large mules, and 25 per cent. of small mules became affected in the scene of an outbreak. "The period of incubation averages three days, starting with an inflamed mouth, then in a short time the formation of vesicles on the sides and point of the tongue, and sometimes on the lips—these break almost immediately, leaving red inflamed surfaces. Constitutional disturbance is slight. Period of attack averages one week. Animals usually eat a little, but fall off considerably in condition."

The bacteriologist (GREGORY G.) of the Depot isolated from the pustules a staphylococcus growing slowly and meagrely on ordinary laboratory media and producing no harmful effects after intraperitoneal inoculation into the rabbit or guinea-pig.

Some transmission experiments were attempted with sub-cultures of this organism. An emulsion rubbed on the tongue and lips of four mules gave negative results after four days, but inflammation of the mouth and mild salivation was observed in three of them on the sixth day. Intravenous inoculation of the organism produced in one mule after 48 hours cording of the veins and lymphatics under the tongue and inflammation of the buccal mucous membrane, copious salivation, and a rise of temperature of 1° F. Inoculation of large doses under the mucous membrane of the tongue produced, in two mules, at the seats of injection after 24 hours, pronounced nodules, and then vesicles in from 48 to 72 hours. The coccus was recovered from these vesicles.

[The author apparently feels justified in heading this brief record of transmission experiments with the words, "A mild form of the disease produced." His experiments are, however, most inconclusive and hastily published. The clinical history of the natural disease is but briefly discussed, but it may be inferred that *multiple* vesicles were found on the lips and buccal mucous membrane and that the disease was extremely contagious. Neither of these conditions were fulfilled in the experiments with the organism described. The author would be well advised to consult the article published recently by DE JONG on what is most probably an identical disease (see above extract).—ED.]

GREGG (James), MCGUIRE (F. X.), GLOVER (G. J.), GILLESPIE (A.) & GREGORY (G.). **Vesicular Stomatitis Contagiosa.**—*Amer. Jl. Vet. Med.* 1917. April. Vol. 12. No. 4. pp. 221–222.

This article is almost entirely identical with that published by Gregg alone (see above) with the exception that another series of experiments in connection with the organisms isolated from the lesions are described.

"The organisms isolated from the inoculated animals were injected into the tongues of two mules, with negative results.

"The original cultures were used on two horses and three mules as follows:—

"(1) A seven-year-old bay gelding had four cc.'s of a heavy suspension injected per jugular with negative result.

"(2) A nine-year-old black gelding had four cc.'s injected under the tongue; result was mild inflammation of the mouth on the third day, which disappeared rapidly.

"(3) A black mule gelding had four cc.'s intravenously with negative result.

"(4) A black mule had four cc.'s injected into the tongue, results were mild inflammation of the mouth on the third and fourth day.

"(5) A grey mule gelding had four cc.'s injected into the tongue. Animal showed active inflammation of the mouth with salivation on the fourth and fifth day."

The authors then add a note stating that at the time of writing the disease had disappeared entirely from their pens and hospitals—"in fact, it went out as suddenly as it came in." The disease is stated to have lasted four months and produced several thousand cases. The symptoms are described a little more fully and they correspond with the descriptions given elsewhere. In this paper the reader is asked to draw his own conclusions from the results of the experiments.

MORI (Nello). **Sul germe specifico della Stomatite pustolosa contagiosa degli equini e Afta di Regis.** [The Causal Organism of Contagious Pustular Stomatitis in Equines or King's Aphtha.]—*Clinica Vet.* 1917. July 15. Vol. 40. No. 13. pp. 381–383.

In 1909 the author studied the above disease in a number of Hungarian remounts imported into Italy. He came to the conclusion that the disease was a pathological entity and not a form of horse-pox as the majority of French, English, and Italian authors maintain. Pure cultures of an organism which he maintains to be similar to that described recently by GREGG (see above) were isolated from the vesicles.

EICHHORN (Adolph). **Vesicular Stomatitis in Cattle.**—*Amer. Jl. Vet. Med.* 1917. Mar. Vol. 12. No. 3. pp. 162 & 170.

The United States Bureau of Animal Industry received rather alarming reports from Kansas and neighbouring parts that a disease existed among the livestock, particularly among cattle and horses, closely resembling foot-and-mouth disease. On arrival at the scene of the outbreak Eichhorn observed that the buccal lesions resembled those of foot-and-mouth disease so closely that a differentiation was almost impossible. In early cases typical vesicular formations with an accumulation of lymph were found. These vesicles ruptured readily, leaving a surface similar to that seen in foot-and-mouth disease. The lesions were not confined to any part of the mouth, the tongue was affected in about 50 per cent. of the cases, the dental pad was rather more frequently affected; the other parts of the buccal mucous membrane showed lesions varying in frequency. The regenerative process progressed very rapidly, the only difference from foot-and-mouth disease being that in some cases the eroded parts were covered with a thick gelatinous pseudo-membrane.

Inoculation tests.—Three calves were inoculated by scarification and five others, kept in another isolated pen, were inoculated intravenously with material from the lesions. The scarified calves developed lesions on the dental pad in 48 hours but these were not quite typical in appearance. The calves inoculated intravenously remained unaffected. Interdigital inoculation of five pigs gave negative results. Likewise horses inoculated by rubbing infected material on the tongue showed no lesions on the third day and so the tongue was re-inoculated by scarification. "One of the horses on the third day developed a vesicle on the dorsum of the tongue and, as in the successful transmission to horses in Washington, on the following day an expansion of the disease was observed affecting almost the entire surface of the tongue."

The disease differed from foot-and-mouth disease in the following respects :—(1) the transmissibility of the disease to horses from cattle and the failure to infect pigs, (2) the absence of foot lesions in infected and exposed cattle, (3) the appearance of newly-formed vesicles after the commencement of the healing process in some cases, (4) the immunity of a large proportion (up to 60 per cent.) of exposed animals in some centres, and (5) the temperature was not observed to rise over 103° F.

JOHNSON (P. E.). **"Infectious Stomatitis."**—*Jl. Amer. Vet. Med. Assoc.* 1917. Mar. Vol. 50. (New Ser. Vol. 3.) No. 7. pp. 882–883.

In this short article the author describes a recent outbreak of stomatitis affecting about 1,000 head of horses and cattle in South Dakota, U.S.A.

In other parts of the United States it has been recognised that this disease may take on either a very mild or a severe course. The disease was introduced into South Dakota by means of five horses which had been exposed to infection in Sioux City. One of these horses showed symptoms on the day after arrival and on the following day similar symptoms were noticed in several other horses. These animals were placed under quarantine as an inspector had noticed the disease in several of the cows and among some of the horses in the yard. "On the same day, immediately preceding the quarantine, and also on the two previous days, there were thirty-five different ranchmen from various parts of the country, that had stabled and fed their teams and saddle horses in the barn and were thus exposed but had removed their horses before the quarantine was placed on the barn. From ninety to ninety-five per cent. of the exposed animals developed the disease. Among the first animals exposed it spread more rapidly than it did later and the disease was more severe in the animals first affected in a herd than in those it developed in later."

"The disease develops in from three to five days after exposure, and it is recognised by the animals refusing to eat and showing a good deal of slobbering. They generally have a rise of temperature of from two to three degrees, and also show some lassitude. The lesions are found mostly on the lips and on the dental pad of the cattle, and on the tongue and sides of the mouth in the horse. In some of the horses the whole upper surface of the tongue was entirely raw, and there was an odor of necrosis, especially in the neglected cases."

The most common method of infection is through eating hay soiled with the saliva of infected animals. The period over which an animal will spread the infection is probably not over one week. The disease causes practically no mortality among stock but the animals are left in a run-down condition from the attack. Treatment consisted in quarantining the exposed stock, separating the infected from the non-infected, and washing the mouths of infected animals with a solution of potassium permanganate once daily. In very severe cases the lesions were curetted and tincture of iodine applied once.

PANISSET (L.). **À propos de la stomatite vésiculeuse du cheval (stomatite ulcéreuse, stomatite érosive).** [Vesicular, Ulcerative, or Erosive Stomatitis in the Horse.]—*Rev. Gén. Méd. Vét.* 1917. May 15. Vol. 26. No. 305. pp. 181–183.

"The vesicular stomatitis observed among horses at the front by some observers and summarily described since 1915 as a new disease has, in the course of the last few months, spread considerably, but not alarmingly as the disease has so far shown no malignant tendencies. The veterinary hospitals especially and numerous units which have received horses from centres primarily affected have suffered considerably from the disease."

The author proceeds to show that this disease was most probably imported into France from America by means of infected remounts. The U.S.A. Bureau of Animal Industry during the latter months of 1916 investigated the disease affecting a very high proportion of remount concentration depots at Chicago, Nebraska, and Colorado. The disease was also seen in America to spread to the ox, but the pig and sheep remained refractory, hence the non-identity of the affection with foot-and-mouth disease. The Bureau, moreover, observed that the disease transmitted by inoculation possessed a longer period of incubation at each new passage. Transmission experiments with filtered products failed.

BURTON (A. C.). **"Stomatitis Contagiosa" in Horses.**—*Vet. Jl.* 1917. July. Vol. 73. No. 7. pp. 234–242. With 4 figs.

This author furnishes a good clinical record of the above disease as it occurs among British army horses in France. The number of outbreaks and cases dealt with is unfortunately omitted.

The disease is defined as "a contagious disease characterised by vesicular eruptions in the mouth with subsequent more serious and characteristic lesions therein; similar lesions on m.m. of oesophagus and stomach, with an acute gastro-enteritis; occasionally, also, an eczematous coronitis." It is stated that the condition is different from the disease described by FRIEDBERGER and FROHNER as "stomatitis contagiosa pustulosa." Horses readily contract the disease; mules are not so susceptible, but are by no means immune. It is transmissible to man; the author himself and two of his assistants contracted it. The disease was of short duration, of a mild character although very painful, and confined to the mouth, the lesions being similar to those described in the case of the horse. The disease is readily amenable to treatment with the aid of mild antiseptics.

The period of incubation is said to be short, 24 hours to three days. The immunity conveyed by one attack appears to be of short duration; re-infection took place in less than two months. All classes and ages of horses are affected to the same degree.

The initial symptom is an inflamed condition of the mucous membrane of the mouth or lips speedily followed by the formation of vesicles. On the lips the vesicles are most common at the junction of the skin and mucous membrane, and are usually discrete and rupture quickly. "A crusty eczematous appearance" is then produced. A few vesicles may appear on the skin itself. Similar vesicles are found within the lips and on the gums and have a tendency to coalesce before bursting. Vesicles are also quite common on the upper and lower palate, especially on the bars, and on the mucous membrane of the cheeks, but they are usually not so severe in these places. The most serious buccal lesion is found on the tongue where the vesicles coalesce over a large area, forming subsequently large eroded patches. Salivation varies in amount, and may not be present at all. It may be said to take place only where tongue lesions exist. In severe cases the odour from the mouth is very offensive, resembling that from the breath of an animal suffering from gangrenous pneumonia. Colic is a frequent symptom, more especially in cases running an unfavourable course. The pulse assumes a rapidly falling character; the visible mucous membranes are highly congested. Fever is present only in very severe cases and in cases complicated with abdominal lesions; the temperature may then reach 103° to 104° F. The appetite remains good where the mouth lesions are not severe but severe lesions prevent feeding and an animal thus affected wastes rapidly. Healing takes place in from a fortnight to two or three months but complications affecting the digestive tract may set in when recovery is apparently complete.

The foot lesions are described as "an eczematous coronitis." The affection is seen in one or more feet, is very painful, and develops rapidly. Acute lameness may set in suddenly, vesicles appear almost immediately, rupture, and a straw-coloured exudate trickles down the wall of the hoof. The heel is the part most often primarily affected and thence the lesions often spread rapidly all round the coronet. The coagulated serum forms a thick crust over the part. These lesions are generally observed at the same time as the mouth lesions.

According to the author the disease often runs "an unfavourable and even fatal course."

On post-mortem examination one finds mouth lesions of varying severity, marked emaciation, although the stomach and intestines may be comparatively full of foodstuffs where the mouth lesions permit of normal feeding. Lesions as on the tongue and lips may be found on the mucous membrane of the oesophagus, also quite commonly in the stomach, especially at the junction of the villous and cuticular membranes, and they are found to vary in age and severity. In such cases an acute gastro-enteritis is invariably found. No characteristic lesion is, however, found in the intestine.

Local treatment by means of antiseptics such as potassium permanganate, potassium chlorate, and copper sulphate appear to have a very beneficial effect. The mode of treatment employed by the author consists in placing all the more seriously affected animals side by side in a stable. Three or four times a day the horses' mouths are washed out with a solution of potassium permanganate (½ oz. to 5 gallons cold water). This solution is carried on the back of a dresser who inserts the nozzle of the sprayer, covered with a piece of rubber hosepipe perforated with a series of small holes, carefully into the mouth of each horse as he passes along in front of the horses. The treatment is apparently not resented by the horses.

GIBBS (H. E.) & POOK (G. G.). **A Report upon an Outbreak of Stomatitis Contagiosa.**—*Vet. Jl.* 1917. May. Vol. 73. No. 5. pp. 147–155. With 4 text figs.

This paper contains some notes on the clinical appearance of the above disease together with brief accounts of two series of experiments. The disease is stated to differ from the " true Pustular Contagiosa, in so far as it is possibly more readily transmissible, certainly extremely benign, and has apparently no deleterious effects on animals suffering from it." [The authors' evidence for this statement is not given. It is not known whether a differentiation from the so-called " true Pustular Contagiosa " is made on account of their personal experience with that disease or from the descriptions given in the literature in connection with it. The article is neither well written nor well edited.]

The temperature was found in some cases to rise to 103° F. 24 hours before the vesicular eruption appeared and remains high for 48 hours. There is a profuse discharge of mucous saliva at the commencement of the disease ; this often becomes frothy later on. In the course of the outbreak animals were noticed with intense salivation and showing only congestion of the buccal mucous membrane, disappearing spontaneously a few days afterwards.

The lesions are found confined to the buccal mucous membrane, most commonly the tongue. They vary considerably in size, a single vesicle often measuring 1 inch in diameter ; a number of vesicles often coalesce to form one large bleb ; this bleb quickly ruptures, discharging a straw-coloured serous fluid, and leaves a raw congested surface to which a few hours afterwards a straw-coloured jelly-like substance is found adherent.

The disease was found to take from four to six weeks to run its course. Healing took place from both the periphery and the bottom of the lesions, in most cases leaving no trace of the disease. Large lip lesions often left behind them elongated scars.

The smaller lesions did not appear to affect the animals' ability to feed, but the larger ones caused difficulty in feeding and consequent loss of condition. The infection was most probably carried by the indirect method. Treatment consisted in feeding on soft food and the administration of antiseptics locally.

Experimental.—The period of incubation after inoculation of the the contents of the vesicles was found not to exceed 24 hours in the case of two horses, one of which was inoculated with the fluid underneath the mucous membrane of the tongue, while in the case of other horse the fluid was applied to the scarified tongue surface. No lesion followed the inoculation of fluid beneath the skin of the coronet.

When the mode of transmission was made to simulate the probable natural method of infection the results were very irregular. Ten horses and five mules were thus isolated and the saliva from the mouths of badly affected animals applied in various ways to their buccal mucous membranes, viz., by application of cotton-wool soaked in discharges, drinking from contaminated vessels, and ingestion of contaminated food, etc. Two of these horses were kept as controls. Typical lesions developed in seven of these horses in from 5 to 19 days. Two of these horses, however, were the controls, which became affected in 10 and 14 days, respectively. The lesions produced in the more retarded cases might thus not have been due to the original application of discharges. Three of the horses and all the mules did not become visibly affected.

In another similar series of experiments in which the same number of animals were used, one horse and three mules being kept as control animals, eight of the horses including the control became affected on the day following the experiment, and the ninth on the second day. The tenth horse developed no lesions. Three of the mules, including two controls, developed lesions on the first day, another control on the second day, and the remaining mule on the fifth day after the commencement of the experiment.

According to the authors' opinion, it is the vesicular contents which should be held responsible for the disease and the lesions lose their infectivity shortly after the rupture of the vesicles. In support of this statement they quote an experiment in which five susceptible horses were rubbed on the scarified surfaces of their tongues with a piece of cotton wool soaked on a serious lesion of four days' standing. No lesions were subsequently found in any of these horses on examination extending over a period of 14 days.

(b) Contagious Agalaxy of Goats.

Sergent (Edm.) & Roig (G.). **Sur l'existence de l'agalaxie contagieuse des chèvres en Algérie, et sur une infection surajoutée.** [Contagious Agalaxy of Goats in Algeria and a Secondary Infection.]—*Bull. Soc. Path. Exot.* 1917. July. Vol. 10. No. 7. pp. 575–585. With 1 text fig. & 1 chart.

Conclusions:

"Contagious agalaxy of goats occurs in Algeria. We witnessed in 1908 an outbreak remarkable on account of its suddenness and its violence. In three months it killed off 124 out of 450 goats (27·5 per cent.), attacking especially the young animals.

"In the natural disease mammary lesions are constant, articular lesions frequent, while ocular lesions were not observed. Thus animals not producing milk only showed articular symptoms.

"In the experimental disease the mammary and articular lesions are constant. Ocular lesions were observed in 2 cases out of 13.

"Inoculation of blood of infected animals did not transmit the disease and produced no subsequent immunity.

"Inoculation of milk subcutaneously or intraperitoneally produces the disease with certainty in goats. Intraperitoneal inoculation does not infect the guinea-pig or the rat.

"The virus did not become attenuated by passages.

"Ingestion of infected milk did not produce the disease.

"One goat contracted the disease by cohabitation.

"In the outbreak studied a polymorphic organism belonging to the Preisz-Nocard group was constantly found in the milk, but not in the blood.

"The inoculation of cultures of this organism was not pathogenic.

"This organism is undoubtedly a concomitant parasite ("*temoin*") of the ultra-visible virus discovered by Celli and Dante de Blasi. It does not even seem to play the part filled by Carré's pyobacillus in 'mal de Lure.'

"It appears to be merely a secondary invader following the infection set up by the specific virus."

(c) Eradication of Locusts.

Velu (H.). **Deuxième campagne d'expérimentation de la méthode d'Hérelle au Maroc contre *Schistocerca peregrina* Olivier (mars-juillet 1916).** [Second Experimental Campaign for the Destruction of Locusts in Morocco by means of D'Hérelle's Method. March-July 1916.]—*Ann. Inst. Pasteur*. 1917. June. Vol. 31. No. 6. pp. 277–290.*

Conclusions:

"From facts observed during the 1915 campaign the following conclusions were drawn:—*There may exist among invading swarms of locusts outbreaks of contagious enteritis set up by a coccobacillus of the same group as D'Hérelle's bacillus.* The severity of these outbreaks is variable. *They prevent the exaltation of the virulence of D'Hérelle's coccobacillus maintained* in vitro.

"*The locusts which are born during the passage of contaminated swarms are infected by means of the dead bodies.*

"The coccobacillary enteritis of locusts is perhaps a more common disease in nature than is at present believed. The mortality observed in 1910 by Dr. D'Hérelle in America is probably common in Africa. This possibly accounts for the disappearance of swarms for several years, and for the long periodicity of the invasions.

"Schistocerca peregrina *Olivier is distinctly susceptible to infection by means of D'Hérelle's coccobacillus at all stages in its development*, but as contamination is brought about almost entirely by means of cannibalism the outbreaks set up are proportional in severity to the ease with which the diseased insects are devoured by their neighbours.

"The factors which tend to render the infestations more efficacious include all those which increase the density of the swarms of locusts and consequently favour cannib lism.

"*The most favourable time for spraying is at the end of the third stage.* The locusts are not then formed up in columns; they form dense compact masses which move about very little. They are so close together that contamination of the pastures is certain and that the affected insects are devoured without fail as soon as they are too weak to protect themselves.

"*From the commencement of the fourth stage and onwards the propagation of the infection is much less certain.* Sprayings no longer have the same efficacity; the density of the columns is less, the distance covered each day becomes gradually greater; the dead bodies are spread out over a large area; *the affected insects form behind the main column échelons of stragglers which die separated from the others and are thus useless for further propagation of the infection.* As one nears the time of the last moult, the columns of locusts become submitted to more and more strict sanitary rules which bring about the automatic elimination of disease carriers. The last stages of larval life are thus not favourable for the application of the biological method, *especially in open country*.

"The application fo D'Herelle's method demands a precision so difficult to obtain that one cannot with our present knowledge consider it as sufficient in itself to bring about wholly the solution of the important problem of eradicating locusts. But on the other hand one cannot dispute that its efficacity when applicable renders it distinctly superior to all other

* The sul ject matter of this paper has previously been dealt with briefly by the author in another paper [see this *Bulletin*, Vol. 5. No. 1. p. 56].

methods, and especially more economical. Without thinking of abandoning any of the other means of protection hitherto employed the greatest and most certain advantages should be taken of the biological method.

"As a very large number of larvae are never hatched at the same time but are hatched successively in the same region at times varying with the aspect and nature of the soil, a single body of men cannot carry out all the infection operations, especially if one admits that these infections must be made on the clusters of larvae before the formation of columns. It is thus indispensable to find out and infect all the masses of locusts before the tenth day. For this purpose one must thus provide an organisation for a district composed in the following manner: One veterinary surgeon belonging to the Department of Animal Industry, three mounted European "infectors" and three camelmen.

"The stocks of broth should be made up in each centre immediately on the arrival of the swarms and the virulent material should be prepared beforehand in the research laboratory of Casablanca.

"Finally, as it has been observed that the swarms just when entering the country showed a considerable mortality and infected the clusters of young locusts, it is best to infect the swarms directly on their arrival in the south, at Agadir, and even further if possible.

"Applied on a large scale the biological method must considerably diminish the damage done by the swarms of locusts as well as that done by the clusters of young locusts, and consequently facilitate in a large measure the mechanical means of combat and reduce the considerable expenditure which this involves." . . .

(d) Camel Purgatives.

Cross (H. E.). **A Note on the Action of Purgatives on the Camel.**—6 pp. 1917. Lahore: Supt. Govt. Printing Punjab.

As the result of experiments in the administration of various quantities of the commonly used purgatives to the camel the author's experience led him to summarise his views as follows:—

"To produce purgation in the camel the following doses require to be given:—8 oz. kamala; 4 pints linseed oil; 3½ drachms of croton oil; 3½ ozs. aloes solution; 1½ to 2 lb. magnesium sulphate; 3 ozs. gamboge; 2 grains eserine and 2 grains pilocarpine given subcutaneously.

"Of the purgatives tried the best purgative for the camel is magnesium sulphate; the others come in the order named:—kamala, croton oil, aloes, gamboge, linseed oil. Eserine and pilocarpine gives very satisfactory results, in doses of 2 grains eserine and 2 grains pilocarpine subcutaneously."

REPORTS.

British Guiana. **Report on the Veterinary Division** (Milne, A. Seton, Government Veterinary Officer). Reports of the Department of Science and Agriculture, for the Nine Months ended 31st December, 1915. Appendix iv. 5 pp. f'cap. 1916. Georgetown, Demerara: Govt. Printers.

The only serious outbreak of infectious disease dealt with in this report was one of anthrax, which was soon brought under control by the inoculation of nearly all the animals (12,000) in the infected area with anthrax vaccine.

Two outbreaks of contagious pneumonia occurred among mules.

There were no outbreaks of swine fever or glanders.

Mal de caderas did not reappear during the year.

An imported shorthorn bull kept for breeding purposes showed continuous daily high fever; its blood was found to contain trypanosomes, which were not identified. Intravenous injection of a Brazilian preparation called "sodium protosonate" every third day soon brought about a recovery and the disappearance of the trypanosomes from the blood.

A few details are added with regard to some small breeding experiments with imported pigs and a stallion.

CEYLON. **Administration Reports, 1916.** Report of Government Veterinary Surgeon [STURGESS, G. W.].—6 pp. f'cap.

A mild outbreak of influenza was the only infectious disease noted among horses.

856 cases of rinderpest were reported amongst cattle as against 1,493 last year; the mortality was about 77 per cent. 223 cattle were inoculated with anti-rinderpest serum and of these 138 remained free of disease; of the remaining 85 affected cattle, 38 recovered and 47 died.

There was a marked decrease in the prevalence of foot-and-mouth disease—284 cases as against 2,366 in 1915.

Four cases of surra were detected; two animals died naturally and two were destroyed.

Anthrax was found to be very prevalent amongst goats and sheep imported from India. Out of 76,820 of these animals imported into the quarantine station at Colombo 1,196 died from anthrax ($1\frac{1}{2}$ per cent.). Twenty deaths from this disease occurred in the island.

An outbreak of infectious ophthalmia occurred amongst cattle involving 64 cases. All recovered under treatment.

The outbreak of so-called swine septicaemia recorded in the preceding year ended in July, 1916. There were 274 cases as against 2,512 in 1915. "A possible carrier of this disease is *Ctenocephalus canis*, which was found infesting sick pigs."

Out of 23 cases of suspected rabies four were found positive.

The following insects were identified:—*Tabanus striatus* Fb., Kandy District, in April; *Pycnosoma flaviceps* Mag., the cause of myiasis in a dog's mouth, Colombo, November; and the tick *Boophilus australis* Fuller, Experiment Station, Peradeniya.

Losses due to parasitic gastritis caused by *Haemonchus contortus* are recorded.

Statistics are included with regard to disease returns, importation of animals, stock farm, and expenditure.

SOUTHERN RHODESIA. **Abridged Report of the Chief Veterinary Surgeon** (SINCLAIR, J. M.). Abridged Report of the Director of Agriculture for the Year 1916. pp. 5–7.

The greater part of this report deals with the outbreaks of East Coast fever in cattle recorded during the year. The year was marked by the appearance of this disease in the Mrewa District, in which it had not at any time previously existed and its re-appearance in the

Gwelo District after over ten years freedom from it. The source of the infection could not be traced in either case. Notwithstanding these outbreaks in previously clean districts the position shows a marked improvement as compared with the previous year. There were fewer fresh outbreaks—20 as against 35—and a greatly decreased mortality—382 as against 1,174. Of the 38 centres in which the disease occurred during 1915 only 15 showed infection during 1916. Details are added with regard to the method of dealing with these outbreaks in the various districts.

Shortly after the heavy rains fell in the Bulalima-Mangwe District in November several outbreaks of blackquarter occurred and the mortality was somewhat heavy. It was reported that animals of all ages contracted the disease and that a number recovered. Only two outbreaks of this disease had previously been recorded since the occupation of the country.

Tuberculosis was detected in one herd. Amongst the 12,719 head of slaughtered cattle exported to the Johannesburg abattoirs five cases of tuberculosis were discovered.

A few fresh centres of contagious abortion were discovered. Treatment by the injection of large doses of dead bacilli is still adopted and the results were apparently favourable.

No cases of anthrax, contagious pleuro-pneumonia of cattle, rabies, or glanders occurred.

The mortality from horse sickness was one of the slightest on record.

An outbreak of equine influenza occurred affecting about 90 per cent. of horses and many mules and donkeys. A slight mortality occurred among donkeys and mules but none in horses.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 5, No. 2, pp. 134–140.]

PROTOZOAN PARASITES.

ALESSANDRINI (S.). Le piroplasmosi ed i mezzi per prevenirle e combatterle. [Piroplasmosis: Methods of Prevention and Eradication.]—*Ann. d'Igiene*, 1917. Feb. 28. Vol. 27. No. 2. pp. 100–110.

BERGMAN (A. V.) & WAXBERG (H.). Uber Hämoglobinämie, Piroplasmose des Rindes in Schweden. [Redwater of Cattle in Sweden.]—*Zeitschr. f. Infektionskr. parasit. Krankheit. u. Hyg. d. Haustiere*, 1917. June. Vol. 18. Nos. 4 & 5. pp. 358–379. With 2 plates comprising 3 figs.

CHATTON (Ed.). Les "Blastocystis," stades du cycle évolutif de Flagellés intestinaux. ["Blastocystis," Stages in the Development of Intestinal Flagellates.]—*C.R. Soc. Biol.*, 1917. June 2. Vol. 80. No. 11. pp. 555–560. With 1 plate comprising 13 figs.

HAHN (C. W.). On the Sporozoon Parasites of Wood's Hole and Vicinity. I. Further Observations on *Myxobolus musculi* from Fundulus.—*Jl. Parasit.*, 1917. Mar. Vol. 3. No. 3. pp. 91-104. With 4 text figs.

——. On the Sporozoon Parasites of the Fishes of Wood's Hole and Vicinity. II. Additional Observations upon *Myxobolus musculi* of Fundulus and a Nearly Related Species, *M. pleuronectidae* of *Pseudopleuronectus americanus.* —*Jl. Parasit.*, 1917. June. Vol. 3. No. 4. pp. 150–160. With 1 plate comprising 18 figs.

ISHIWATA (S.). Note on a Species of Nosema Infecting *Attacus cynthia*, Drury.—*Jl. Parasit.*, 1917. Mar. Vol. 3. No. 3. pp. 136–137. With 8 text figs.

JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 1917. Feb. 17. Brazilian Trypanosomiasis—Chagas's Disease.—Extracted in *Jl. Trop. Med. & Hyg.*, 1917. Apr. 2. Vol. 20. No. 7. p. 84.

KAMM (Minnie Watson). The Development of Gregarines and Their Relation to the Host Tissues: (I) In *Stenophora lactaria* Watson.—*Jl. Parasit.*, 1917. Mar. Vol. 3. No. 3. pp. 124-130. With 2 plates comprising 12 figs.

KUDO (Rokusaburo). Contributions to the Study of Parasitic Protozoa. II. *Myxobolus toyamai* nov. spec., a New Myxosporidian Parasite in *Cyprinus caprio* L.—*Jl. Parasit.*, 1917. June. Vol. 3. No. 4. pp. 163-170. With 2 plates comprising 45 figs.

NOGUCHI (Hideyo). Spirochaetes.—*Jl. Lab. & Clin. Med.*, 1917. Mar. & Apr. Vol. 2. Nos. 6 & 7. pp. 365–400 & 472–499.

[An admirable essay dealing with the whole subject of spirochaetes. No justice could be done to the papers in an extract and they should be consulted in the original by those interested. A bibliography consisting of 283 references is appended.]

—— & AKATSU (Seinai). Immunological Studies on Pure Cultures of Various Spirochetes.—*Jl. Experim. Med.*, 1917. June 1. Vol. 25. No. 6. pp. 765–788.

PLOTZ (Harry). Cultivation of *Spirochaeta obermeieri.*—*Jl. Experim. Med.*, 1917. July 1. Vol. 26. No. 1. pp. 37–39. With 1 plate.

VAN SACEGHEM (R.). Contribution à l'Etude de la Transmission du *Trypanosoma Cazalboui.* [Transmission of *T. cazalboui.*]—*Bull. Agric. Congo Belge,* 1916. Sept.-Dec. Vol. 7. Nos. 3 & 4. pp. 231-235.

[This article has already been extracted from another paper, see this *Bulletin,* Vol. 4. No. 4 pp. 159-160.]

METAZOAN PARASITES.

Arthropods (Acari, Flies, Ticks).

CRAIG (J. F.). The Presence of Psoroptes in the Ears of Sheep.—*Vet. Record,* 1917. June 2. Vol. 30. No. 1508. pp. 503-504.

HADWEN (S.). The Life History of *Hypoderma bovis* and *H. lineatum.*—*Jl. Amer. Vet. Med. Assoc.,* 1917. July. Vol. 4. No. 4. pp. 541-544.

HALL (M. C.). Notes in Regard to Horse Lice, Trichodectes and Haematopinus.—*Jl. Amer. Vet. Med. Assoc.,* 1917. July. Vol. 4. No. 4. pp. 494-504.

LARISCH (P.). Die Bekämpfung der Gastrophilus larve. [Treatment of Gastrophilus Larvae.]—*Berlin. Tier. Woch.,* 1917. May 3. Vol. 33. No. 18. pp. 210-211.

MATTHIESEN, PEETS & DAHLGRÜN. Viehverluste in den Niederungen der Leine und Aller durch die Stiche der Kriebelmücke, *Simulium reptans* L. [Losses among Cattle through the Bites of *Simulium reptans.*]—*Berlin. Tier. Woch.,* 1917. Apr. 26. Vol. 33. No. 17. pp. 193-197.

PARROT (L.). Sur un nouveau Phlébotome algérien *Phlebotomus Sergenti,* sp. nov. (Note préliminaire). [A New Algerian Phlebotomus.]—*Bull. Soc. Path. Exot.,* 1917. July. Vol. 10. No. 7. pp. 564-567. With 11 figs.

RHODESIA AGRICULTURAL JOURNAL, 1916. Aug. Vol. 13. No. 4. p. 464. —Tick Eradication Day.

ROUBAUD (E.). Le larve del *Gastrophilus equis*—Autoinoculazione e sviluppo primario nelle mucose della bocca. [Larva of *Gastrophilus equi*; Autoinoculation and Primary Development in the Buccal Mucous Membrane.]—*C.R. Acad. Sci.* Vol. 164. No. 111. Extracted in *Clinica Vet.,* 1917. July 15. Vol. 30. No. 13. pp. 397-398.

SCOTT (Hugh). Notes on Nycteribiidae, with Descriptions of Two New Genera.—*Parasitology,* 1917. July. Vol. 9. No. 4. pp. 593-610. With 1 plate comprising 5 figs.

Helminths.

BLANCHARD (R.). Monographie des Hémadipsines (*Sangsues terrestres*). [Monograph on the Haemadipsina (Land Leeches).]—*Bull. Soc. Path. Exot.,* 1917. July. Vol. 10. No. 7. pp. 640-675. With 1 plate comprising 14 figs., & 17 text figs.

BLANCHARD & GRELLET. Valeur antiparasitaire du formol. [Value of Formalin as a Parasiticide.]—*Bull. Acad. Méd.,* 1916. Oct. 31. Extracted in *Rec. Méd. Vét.,* 1917. June 15. Vol. 93. No. 11. p. 298.

CAWSTON (F. G.). The Cercariae of Natal.—*Jl. Parasit.,* 1917. Mar. Vol. 3. No. 4. pp. 131-135.

CÉSARI. Echinococcus Cyst in the Heart of a Horse.—*Bull. Soc. Cent. Méd. Vét.* Extracted in *Vet. Record,* 1917. May 19. Vol. 29. No. 1506. p. 481.

CIUREA (J.). Die Auffindung der Larven von *Opisthorchis felineus, Pseudamphistomum danubiense* und *Metorchis albidus*, und die morphologische Entwicklung dieser Larven zu den geschlects-reifen Würmen. [The Discovery of the Larvae of *O.f., P.d.*, and *M.a.* and the Morphological Development of these Larvae into Sexually Mature Worms.]—*Zeitschr. f. Infektionskr.. parasit. Krankheit. u. Hyg. d. Haustiere.*, 1917. June. Vol. 18. Nos. 4 & 5. pp. 345–357 (continuation and end). With 1 table & 1 plate comprising 5 figs.

DICKENSON (Campbell G.). A Case of Splenic Abscess, Secondary to Invasion of the Stomach Wall of a Horse by *Spiroptera Megastoma.* —*Vet. Jl.*, 1917. Apr. Vol. 73. No. 4. pp. 14–15.

DOUMA (S.). Uber einige Fälle von Sklerostomiasis bei Füllen und Pferden. [Sclerostomiasis in Foals and Horses.]—*Berlin. Tier. Woch.*, 1917. May 3. Vol. 33. No. 18. pp. 208–210.

FAUST (E. C.). Notes on Cercariae of the Bitter Root Valley, Montana.—*Jl. Parasit.*, 1917. Mar. Vol. 3. No. 3. pp. 105–123. With 1 plate comprising 20 figs.

FEUEREISSEN (W.). Contributo allo studio dello strongilide " *Syngamus bronchialis* " negli uccelli da cortile. [*Sygamus bronchialis* in Domesticated Poultry.]—*Zeitschr. f. Fleisch-u. Milch Hyg.* Vol. 27. Extracted in *Clinica Vet.*, 1917. July 15. Vol. 30. No. 13. pp. 398–399.

GARCIA È IZCARA. Ethereal Extract of Male Fern in Distomatosis.—*El Pecuario Espanol.* Extracted in *Vet. Record*, 1917. Aug. 18. Vol. 30. No. 1519. p. 73.

MENDOZA-GUAZON (Maria Paz). A Case of Infestation with *Dipylidium Caninum.*—*Philippine Jl. Sci.*, 1916. Jan. Vol. 11. Sec. B. No. 1. pp. 19–31. With 3 text figs.

MOUSSU. Oil of Male Fern in Distomatosis.—*Bull. Soc. Cent. Méd. Vet.* Extracted in *Vet. Record*, 1917. Aug. 18. Vol. 30. No. 1519. p. 73.

RANSOM (B. H.). Destruction de la vitalité du *Cysticercus bovis* par la congelation. [Destruction of Vitality of *C. b.* by Freezing.]—*Jl. Parasit.*, 1914. Sept. Extracted in *Rec. Méd. Vét.*, 1917. Mar. 15. Vol. 93. No. 5. pp. 146–147.

RANSOM (B. H.) & HALL (M. C.). A Further Note on the Life-History of *Gonglyonema scutatum.*—*Jl. Parasit.*, 1917. June. Vol. 3. No. 4. pp. 177–181.

RILEY (W. A.). Another Case of the Occurrence of the Giant Nematode, *Dioctophyme Renale*, in the Abdominal Cavity, and Data Bearing upon the Theory of Entry *via* the Genito-Urinary Tract.—*Cornell Vet.*, 1917. Jan. Vol. 7. No. 1. pp. 43–45.

SKRJABIN (K. I.). Sur quelques Nématodes des Oiseaux de la Russie. [Some Nematodes of Birds in Russia.]—*Parasitology*, 1917. July. Vol. 9. No. 4. pp. 460–481. With 2 plates comprising 19 figs. & 1 text fig.

WIRTH (D.). Filariosen bei einheimischen Pferden (Vierte Mitteilung). [Filariasis in Hungarian Horses.]—*Zeitschr. f. Infektionskr., parasit. Krankheit. u. Hyg. y. Haustiere*, 1917. June. Vol. 18. Nos. 4 & 5. pp. 380–413. With 4 plates comprising 10 figs.

YORKE (Warrington) & BLACKLOCK (B.). The Occurrence of *Ankylostoma ceylanicum* in West African Dogs.—*Ann. Trop. Med. & Parasit.*, 1917. June. Vol. 11. No. 1. pp. 69–74. With 6 text figs.

YOSHIDA (Sadao). The Occurrence of *Bothriocephalus liguloides*, Leuckart, with Especial Reference to its Development.—*Jl. Parasit.*, 1917. June. Vol. 3. No. 4. pp. 171–176. With 1 text fig.

——. Some Cestodes from Japanese Selachians. Including Five New Species.—*Parasitology*, 1917. July. Vol. 9. No. 4. pp. 560–592. With 1 plate comprising 21 figs. & 4 text figs.

MYCOTIC DISEASES.

GAIR (G.). Streptotrichosis or Pseudo-Actinomycosis in Man (Pseudo-Tuberculosis).—*Vet. Jl.*, 1917. Mar. Vol. 73. No. 3. pp. 96–100.

HOUDEMEYER (E.). Neosalvarsan in the Treatment of Epizootic Lymphangitis.—*Rev. Gén. Méd. Vét.* Extracted in *Vet. Record*, 1917. Mar. 10. Vol. 29. No. 1496. pp. 372–373.

SANI (Luigi). Ricerche sperimentali su una nuova varieta di "*Nocardia bovis*": "*Actinomices Lanfranchii*." [A New Variety of *Nocardia bovis*.]—*Clinica Vet.*, 1917. June 15. Vol. 40. No. 11. pp. 325–327.

DISEASES DUE TO FILTERABLE VIRUSES.

ANÓNINO. Vacunaciones preventivas contra la perineumonía contagiosa realizadas en 1916. [Preventive Vaccination against Contagious Pleuro-Pneumonia carried out in 1916.]—Extracted in *Rev. Hyg. y Sanid. Pecuarias*, 1917. June. Vol. 9. No. 3. pp. 189–190.

ANÓNIMO. La fiebre aftosa y la pseudo fiebre aftosa. [Foot and Mouth Disease and Pseudo-F. and M. Disease.]—Extracted in *Rev. Hyg. y Sanid. Pecuarias*, 1917. June. Vol. 9. No. 3. pp. 190–191.

BECLÈRE. Inoculabilité de la variole à la genisse vaccinée mais non complètement immunisée. [Inoculability of Variola into the Vaccinated but Not Completely Immunised Heifer.]—*C.R. Acad. Sci.*, 1916. No. 27. Extracted in *Rec. Méd. Vét.* Jan. 15–Feb. 15. Vol. 93. Nos. 1 & 2. pp. 76–77.

BIRCH (R. R.). Hog Cholera Transmission through Infected Pork.—*Jl. Amer. Vet. Med. Assoc.*, 1917. June. Vol. 51. (New Ser. Vol. 4). No. 3. pp. 303–330.

——. A Note on the Immunity of Suckling Pigs to Hog Cholera.—*Cornell Vet.*, 1917 July. Vol. 7. No. 3. pp. 199–200.

CLINICA VETERINARIA, 1917. Apr. 15. Vol. 40. No. 7. pp. 191–193. Gli studi e gli esperimenti d'immunizzazione del bestiame contro l'afta epizootica. [Studies and Experiments in the Immunisation of Cattle against Foot and Mouth Disease.]

ISEPPONI, GUETG & TGETGEL. Erwiderung auf die amtlichen Berichte über die Resultate der Behandlung der Maul-und Klauenseuche nach Prof. Hoffmann, in Mühlen und Zuoz. [Reply to the Official Report on the Treatment of Foot and Mouth Disease according to Hoffmann in M. and Z.]—*Schweiz. Arch. f. Tierheilk.*, 1917. June. Vol. 59. No. 6. pp. 340–349.

JUNGERMAN (G. F.). Rabies with apparently Long Periods of Incubation.—*Amer. Vet. Jl. Med.*, 1917. June. Vol. 12. No. 6. pp. 398.

[Of 4 horses bitten by a rabid dog on a farm one developed symptoms in 1 month, a second in 2 months and a third in 9 months; the remaining horse showed no symptoms.]

KERNKAMP (H. C. H.). Summary of Observations on 1,470 Hogs, Hyperimmune to Hog Cholera.—*Jl. Amer. Vet. Med. Assoc.*, 1917. July. Vol. 51. (New Ser. Vol. 4). No. 4. pp. 537–540.

LORSCHEID. Zwei Fälle von perniziöser Anämie bei Militärpferden. [Two Cases of Pernicious Anaemia in Army Horses.]—*Berlin. Tier. Woch.*, 1917. April 26. Vol. 33. No. 17. pp. 198–199.

MARTEL. La rage à Paris et dans le département de la Seine. [Rabies in Paris and in the Seine Department.]—*Bull. Soc. Cent. Méd. Vét.*, 1917. Apr. 19. *Rec. Méd. Vét.*, 1917. Apr. 30–May 30. Vol. 92. Nos. 9 & 10. pp. 157–176. With 7 figs.

MAZZUOLI (S.). Observations sur la peste aviare. *Clinica Vet.*, 1916. Jan. 15. Extracted in *Rev. Gén. Méd. Vét.*, 1917. July 15. Vol. 26. No. 307. p. 305.

POWLEY (J. O.). Swine Fever.—*Vet. Record*, 1917. March 17. No. 1497. pp. 383–390.

SIEGMUND (B.). Lyssa. [Rabies.]—*Schweiz. Arch. f. Tierheilk.*, 1917. April. Vol. 59. No. 4. pp. 211–220.

STOCKMAN (S.). Serum Treatment in Swine Fever. *Vet. Record*, 1917. Mar. 24. Vol. 29. No. 1498. pp. 394–397.

WHITING (R. A.). The Virulence of Hog-Cholera Blood at Different Periods during the Disease.—*Jl. Amer. Vet. Med. Assoc.*, 1917. July. Vol. 51. (New Ser. Vol. 4). No. 4. pp. 477–493.

BACTERIAL DISEASES.

BLANC (Georges). Enquête sur les chèvres laitières de la Marsa (Tunisie) au sujet de la fièvre méditerranéenne. [Inquiry among the Milch Goats of Marsa (Tunis) with regard to Undulant Fever.]—*Bull. Soc. Path. Exot.*, 1917. May. Vol. 10. No. 5. pp. 376–377.

BOGUE (T. G. S.). Treatment of Ulcerative Cellulitis with Picric Acid.—*Vet. Jl.*, 1917. Aug. Vol. 73. No. 8. pp. 288–290.

BRANFORD (R.). Note of an Outbreak of Contagious Pneumonia in Donkeys. —*Vet. Record*, 1917. July 7. Vol. 29. No. 1513. pp. 1–4.

BUCKLEY (John S.) & SHIPPEN (Lloyd P.). Preliminary Report on the Relation of Anaerobic Organisms to Forage Poisoning.—*Jl. Amer. Vet. Med. Assoc.*, 1917. Mar. Vol. 50. (New Ser. Vol. 3). No. 7. pp. 809–816.

DALRYMPLE (W. H.). Anthrax (Charbon).—*Jl. Amer. Vet. Med. Assoc.*, 1917. Mar. Vol. 50. (New Ser. Vol. 3). No. 7. pp. 831–846. With 5 figs.

EICHHORN (A.). Blackleg Filtrate.—*Jl. Amer. Vet. Med. Assoc.*, 1917. June. Vol. 51. (New Ser. Vol. 4). No. 3. pp. 406–413.

FERRY (N. S.). Desiccated Anthrax Antigen for Immunization Purposes. —*Jl. Amer. Vet. Med. Assoc.*, 1917. May. Vol. 51. (New Ser. Vol. 4). No. 2. pp. 200–203.

LOESER (A.). Ueber die Einwirkung einiger Chininderivate auf den Schweinerotlauf Bacillus. [The Influence of Some Quinine Derivatives on the Swine Erysipelas Bacillus.]—*Zeitschr. f. Immunitätsforsch.*, 1916. Sept. 4. Vol. 25. No. 2. pp. 140–153

MOHLER (John R.). Shipping Fever of Horses.—*Jl. Amer. Vet. Med. Assoc.*, 1917. Mar. Vol. 50. (New Ser. Vol. 3). No. 7 pp. 817–823.

PFEILER (W.). Die Erkennung der bakteriellen Infektionskrankheiten mittels der Präzipitationsmethode. [Diagnosis of Bacterial Diseases by means of the Precipitation Test.]—*Zeitschr. f. Infektionskr. parasit. Krankheit. u. Hyg. d. Haustiere*, 1917. June. Vol. 18. Nos. 4 & 5. pp. 440–456 (continuation).

Poels (J.). Keratitis Infectiosa in Cattle (Keratitis Pyobacillosa).—*Jl. Amer. Vet. Med. Assoc.*, 1917. July. Vol. 51. (New Ser. Vol. 4). No. 4. pp. 526–531 (translation).

Sani (Luigi). Il cane nella propagazione del carbonchio ematico. [The Dog as a Carrier of Anthrax.]—*Clinica Vet.*, 1917. June 15. Vol. 40. No. 11. pp. 315–324.

Smith & Mitter. Note sur une épidémie de septicémie sur les faisans du jardin zoologique de Calcutta. [A Note on an Outbreak of Septicaemia among Pheasants in the Calcutta Zoological Gardens.]—*Vet. Jl.*, 1916. Jan. Extracted in *Rev. Gén. Méd. Vét.*, 1917. June 15. Vol. 26. No. 306. p. 242.

Stazzi (P.). Alcuni osservazioni sul carbonchio ematico. [Anthrax.]—*Clinica Vet.*, 1917. Jan. 31–Mar. 15. Vol. 40. Nos. 2 to 5. pp. 52–57, 103–108 & 133–140.

Ward (A. R.) & **Gallagher** (B. A.). An Intradermal Test for Bacterium Pullorum Infection in Fowls.—*U. S. Dept. of Agric. Bulletin.* No. 517. 1917. Feb. 16. 15 pp.

MISCELLANEOUS.

Bevan (L. E. W.). Immunity in its Relation to the Stock Diseases of Southern Rhodesia.—*Rhodesia Agric. Jl.*, 1916. Oct. & Dec. Vol. 13. Nos. 5 & 6. pp. 640–651 & 800–812. 1917. Apr. Vol. 14. No. 2. pp. 213–234.

Blair (W. R.) & **Brooks** (H.). Osteomalacia or Cage Paralysis in Primates.—*Jl. Amer. Vet. Med. Assoc.*, 1917. June. Vol. 51. (New Ser. Vol. 4). No. 3. pp. 330–347.

Bobeau. Immunisation des serpents venimeux contre les venins. [Immunisation of Venomous Snakes against Venoms.]—*Rev. Path. Comp.*, 1917. June. Vol. 17. No. 135. pp. 19–21.

Buxton (J. B.). The Temperature Required for the "Inactivation" of Mule Blood for the Complement Fixation Test for Glanders.—*Vet. Jl.*, 1917. July. Vol. 73. No. 7. pp. 245–247.

Chambers (F.). Note on the Treatment of Specific Ophthalmia.—*Jl. Comp. Path. & Therap.*, 1917. June. Vol. 30. No. 2. pp. 136–137.

du Toit (P. J.). Beitrag zur Morphologie des normalen und des leukämischen Rinderblutes. [Morphology of Normal and Leukaemic Ox Blood.]—*Arch. f. wiss. u. prakt. Tierheilk.*, 1917. April 14. Vol. 43. Nos. 2 and 3. pp. 145–202. With 2 plates.

Facer (A. W.). An Investigation of the Oxidation of Cattle Dips when Bottled.—*Rhodesia Agric. Jl.*, 1917. Apr. Vol. 14. No. 2. pp. 202–205.

Finzi (G.). Paresi osteomalacica in una giovine scimmia e osteomalacia. [Partial Paralysis caused by Osteomalacia in a Young Monkey.]—*Clinica Vet.*, 1917. June 15. Vol. 40. No. 11. pp. 301–314.

Graham (Robert) & **Himmelberger** (L. R.). Studies in Forage Poisoning.—*Jl. Amer. Vet. Med. Assoc.*, 1917. May. Vol. 51. (New Ser. Vol. 4). No. 2. pp. 164–187. With 6 plates.

Henschen (Folke). Zur Frage der Hühnerleukämie. [Fowl Leukaemia.]—*Arch. f. wiss. u. prakt. Tierheilk.*, 1917. April. 14. Vol. 43. Nos. 2 & 3. pp. 203–232.

Holborow (A. G.). A Preservative for Samples of Arsenical Dips for Analysis.—*Rhodesia Agric. Jl.*, 1916. Dec. Vol. 13. No. 6 pp. 816–818.

KNUTH (P.). Ueber die Lymphozytomatose des Rindes. [Lymphocytomatosis of Cattle.]—*Arch. f. wiss. u. prakt. Tierheilk.*, 1917. Apr. 14. Vol. 43. Nos. 2 & 3. pp. 129–144.

—— & DU TOIT (P. J.). Weitere Untersuchungen über die Lymphozytomatose des Rindes. [Further Investigations on Lymphocytomatosis of Cattle.]—*Berlin. Tier. Woch.*, 1917. May 3. Vol. 33. No. 18. pp. 205–208.

LEESE (A. S.). "Tips" on Camels for Veterinary Surgeons on Active Service.—*Vet. Jl.* 1917. Mar. to Aug. Vol. 73. Nos. 3–8. pp. 79–89, 136–140, 167–173, 214–218, 253–259 & 294–298 (to be continued).

LESCHLY (W.). Versuche über Komplement. III. Die Komplemente verschiedener Tiere. [Experiments on Complement. III. The Complement of Various Animals.]—*Zeitschr. f. Immunitätsforsch.* 1916. Sept. 4. Vol. 25. No. 2. pp. 107–139.

McINTYRE (G.). Remarks on Sand Colic as met with in Egypt.—*Vet. Jl.*, 1917. Aug. Vol. 73. No. 8. pp. 282–284.

MARSH (C. Dwight). Potassium Permanganate as an Antidote for the Effects of Poisonous Plants.—*Jl. Amer. Vet. Med. Assoc.*, 1917. June. Vol. 51. (New Ser. Vol. 4). No. 3. pp. 419–420.

MITCHELL (D. T.). The Effects of the Venom of Serpents upon Animals and the Preparation of Anti-Toxic Serum.—Extracted in *Vet. Record*, 1917. May 19. Vol. 29. No. 1,506. pp. 480–481.

PAINE (R.). Rickets in Donkeys.—*Jl. Comp. Path. & Therap.*, 1917. June. Vol. 30. Pt. 2. pp. 134–135. With 2 text figs.

PHISALIX & CAIUS (R. P. F.). Propriétés venimeuses de la sécrétion parotidienne chez les Colubridés Aglyphes des espèces *Lycodon aulicus, Dendrophis pictus* et *Zamenis mucosus.* [Venomous Properties of the Parotid Secretion of Certain Non-Biting Snakes.] —*Bull. Soc. Path. Exot.*, 1917. June. Vol. 10. No. 6. pp. 474–480.

PICKENS (E. M.). Some of the Infectious Diseases of Poultry.—*Cornell Vet.*, 1917. July. Vol. 7. No. 3. pp. 151–184.

REVUE GÉNÉRALE DE MÉDECINE VÉTÉRINAIRE, 1917. July 15. Vol. 26. No. 307. p. 330.—Ecole vétérinaire en Indo-Chine. [Veterinary School in French Indo-China.]

RHODESIA AGRICULTURAL JOURNAL, 1917. June. Vol. 14. No. 3. pp. 332–338.—Cattle Crush Pens.

SANI (Luigi). Sull'esame microscopico di strisci non colorati. [Microscopic Examination of Fresh Smears.]—*Nuovo Ercolani*, 1917. May 15. Vol. 22. No. 9. pp. 146–147.

SHEPPARD (Frank). Prevention of Poultry Diseases.—*Rhodesia Agric. Jl.*, 1916. Dec. Vol. 13. No. 6. pp. 836–844.

SMILLIE (Wilson G.). New Anaerobic Methods.—*Jl. Experim. Med.*, 1917. July 1. Vol. 26. No. 1. pp. 59–66. With 2 text figs. & 1 plate.

STOCKMAN (Stewart). Poisoning of Cattle with British Ragwort.—*Jl. Comp. Path. & Therap.*, 1917. June. Vol. 30. Pt. 2. pp. 131–134.

VETERINARY RECORD, 1917. June 30. Vol. 29. No. 1,512. p. 544.—Stock-raising in German S.W. Africa.

WELLS (Clifford W.). Leukopenia and Leukocytosis in Rabbits.—*Jl. Infect. Dis.*, 1917. Feb. Vol. 20. No. 2. pp. 219–231.

For CONTENTS, see pages 3 & 4 of Cover

pp. 221-304.] [December 30, 1917.

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TROPICAL VETERINARY BULLETIN.

VOL. 5.] 1917. [No. 4.

DISEASES DUE TO PROTOZOAN PARASITES.

JACK (Rupert W.). **Natural Transmission of Trypanosomiasis (*T. pecorum* Group) in the Absence of Tsetse-Fly.**—*Bull. Entom. Res.* 1917. Aug. Vol. 8. Part 1. pp. 35–41. With 2 maps.

In this article Jack records a series of observations made in Southern Rhodesia during the past seven years, tending to show that in certain conditions the transmission of trypanosomiasis has occurred more frequently in the absence of the tsetse fly than has been generally recognised. Details are thus given concerning limited outbreaks in six separate localities, situated at certain considerable distances from either the Gatooma tsetse area or the fly areas in the Sebungwe District. No tsetse flies were at any time discoverable in these localities. Four of these outbreaks involved cattle of which a certain number were used for draught purposes and had travelled over considerable distances, in some cases either in close proximity to or even into a known tsetse fly area; the remaining two outbreaks involved groups of swine. The situation of the infected centres and the routes taken by the draught oxen are carefully traced on the maps; the trypanosome was identified in each case by BEVAN (Ll. E. W.).

In discussing these outbreaks the author calls special attention to the following points:—

"(1) In all cases the outbreak attained its height during the spring and summer months (October–April).

"(2) In all cases, in connection with which sufficient time has elapsed for such observation, there has been no recrudescence of the disease in the following season, although susceptible animals have still been kept in the same locality." (In a footnote the author points out that this is contrary to the experience in Barotseland and Portuguese East Africa.)

"(3) In all cases infection occurred only amongst animals that were herded together."

The time of the year in which the maximum number of cases are noted does not give any considerable assistance in identifying the species of fly responsible for the transmission of the disease as, apart from *Glossina morsitans* and certain species of Hippobosca, all the common blood-sucking flies are very much scarcer in winter than in summer. The most probable agents are included in the following

(C421) Wt.P2/33. 650. 1.18. B.&F.Ltd. Gp.11/5. A

species :—*Tabanus fuscipes*, *T. taeniola*, various species of Haematopota especially *H. pertinens*, *Stomoxys calcitrans*, Lyperosia, and mosquitoes. Of these *S. calcitrans* and mosquitoes were the only agents that were everywhere abundant throughout the season over which infection extended. The power of mechanical transmission need not necessarily, however, be confined to one species or to one family.

In addition the author maintains that the disease is not readily transmissible under Southern Rhodesian conditions by the above agents from chronic cases that live over until the rains or recover, and also that the transmitting agents are not capable of perpetuating the disease indefinitely or are only capable of doing so under exceptional circumstances. Experience in the territory where " fly-struck " cattle have been freely moved into fly-free areas has shown that "these movements have not resulted in *establishing* trypanosomiasis in any area away from the fly belts." It follows also that the method of transmission in the outbreaks described is of a mechanical and not of a cyclical nature and that the segregation of infected animals (on showing a rise in temperature) would in the absence of tsetse effectively check the spread of the disease.

" In no instance as yet recorded in Southern Rhodesia, however, can Glossina be definitely disassociated from the *inception* of the outbreak. The main point is, that the herding of 'fly-struck' cases with healthy animals is a practice attended with danger, especially in the spring and summer months."

CHAMBERS (F.). **Note on the Transmission of Animal Trypanosomiasis in Northern Rhodesia by Blood-Sucking Flies other than Glossina** —*Vet. Review.* 1917. Aug. Vol. 1. No. 3. pp. 222–227.

In this note Chambers summarises the observations and experiments of a number of authors who have reported the occurrence of trypanosomiasis in Northern Rhodesia and adjoining territories definitely known to be free of the tsetse fly. Some of these reports have already been extracted in this *Bulletin*. The author places no observations of his own on record.

In 1908 a chronic disease made its appearance amongst cattle grazing on the northern banks of the Zambesi; the disease was confined to an area extending from Livingstone to Sesheke and was popularly called Sesheke sickness. A detailed reference is made to G. E. OWEN's manuscript report (1912–1913) showing that the disease was caused by a trypanosome believed to be of the *dimorphon* type [this *Bulletin*, Vol. 2, No. 4, p. 167]. OWEN regarded the disease as being transmitted mechanically by means of Tabanidae.

KINGHORN and YORKE (1912) recorded a case of trypanosomiasis of a cow in a certain locality in North-Eastern Rhodesia, where no tsetse flies were found but Stomoxys and Tabanidae were common [this *Bulletin*, Vol. 1, No. 2, p. 79]. HART (R. L. L.) (1911) similarly observed cattle affected with trypanosomiasis on a tsetse-free farm in the same district; Pangonia and *Stomoxys nigra* were shown to be possible transmitters. MONTGOMERY and KINGHORN (1907) suggested that *Stomoxys calcitrans* and Lyperosia were capable of acting as transmitters. Failure to effect cyclical transmission by means of Tabanidae and ticks was demonstrated by KINGHORN and YORKE (1906) in the case of *T. rhodesiense.* Reference is also made to the failure to transmit *T. gambiense* by means of *Stomoxys nigra* and *S. calcitrans* by DUKE (1913) [this *Bulletin*, Vol. 1, No. 4, p. 215].

JOWETT (1910–11) described the occurrence of trypanosomiasis in a tsetse-free area in Portuguese East Africa after the introduction into a herd of some animals that had probably passed through a tsetse belt. Positive results were obtained in one feeding experiment with Stomoxys and Haematopota. ROGERS as long ago as 1901 showed that Tabanidae were capable of transmitting *T. evansi* within 24 hours after biting an infected animal.

DOEVE (W. C. A.). **Mededeelingen betreffende Surra.** [Information regarding Surra.]—*Veeartsenijkundige Bladen v. Nederl.-Indië.* 1917. Vol. 29. No. 1. pp. 4–15.

This article deals with the clinical course of naturally contracted surra in buffaloes. No information was obtainable regarding the period of incubation as experiments dealing with artificial infection were not performed. The disease is stated to commence as an acute infection, for this is the type observed in animals introduced into surra-infected districts from clean districts. During this acute preliminary stage the animals always show a rise of temperature (39° to 40° C.), erect hair and disturbances in connection with the digestive tract,—decreased appetite, irregularities and careless chewing of the cud, and alternating constipation and diarrhoea; the conjunctiva is markedly congested and keratitis is sometimes observed. Sometimes the animals show symptoms of complete blindness without any apparent abnormality in connection with the eyes. The buffaloes are also affected with nasal catarrh, sometimes with oedema around the pharynx, and more rarely with an intense oedematous swelling of the tongue. These last symptoms led the author at first to suspect that he was dealing with haemorrhagic septicaemia but inoculation of pigeons proved negative whereas inoculation of rats always proved fatal. Acute cerebral symptoms may also be observed—the animals fall suddenly, rise, run as if affected with mania, fall again, and then remain lying on one side quite exhausted. In young and debilitated animals death follows, but full-grown and strong animals generally recover after these attacks of vertigo. The animals also frequently have a frightened appearance and hold their heads raised as if affected with opisthotonus. Circling movements were not observed. This commencing acute stage lasts about a week, and animals that have recovered from this stage generally show no apparent abnormalities. When they have not completely recovered they can, however, be proved to be infected by blood examination and inoculation. If the animal is well fed and kept indoors so that re-infection cannot take place then it completely recovers in three months, as can be verified by blood inoculation. If the animal is turned out to grass and worked and especially if the feeding is neglected then complete recovery is retarded. The animal may be re-infected in districts where surra is enzootic.

Animals which do not completely recover can thus be divided into two groups, viz., those which show no apparent ill-effects from surra and those in which the disease produces gradually increasing ill-effects; this division depends largely on the nature of the feeding. In a district in the Dutch East Indies well known to the author the buffaloes to a large extent harbour surra trypanosomes in their blood; in the western part of this district, where the grazing is good, the animals do not seem to suffer from the parasites as much as they do in the poorer eastern part. In all cases exacerbations may appear during the chronic course of the disease owing to bad feeding and a return of the acute symptoms may thus set in. The chances of recovery depend largely on the number and severity of these relapses. Exposure to inclement weather such as long continued rain and wind is also liable to set up a return of the acute form and mortality, especially among calves; this mortality rate is arrested whenever the weather conditions improve; this factor, however, is not of such great importance as the feeding.

Clinically affected buffaloes should not be allowed to work with healthy oxen; they are not only a danger to the horses which may also be employed at the work but, if the animals are badly fed and the previously healthy animals contract the acute form of the disease, the latter will suffer from a steadily increasing loss of condition, whereas the chronic carriers of trypanosomes may not apparently suffer in the same conditions.

In buffaloes suffering apparent ill-effects from chronic surra the symptoms are as follows:—the animals become thin, the hind-quarters insensitive and the gait more or less unsteady; they are of very little use for work, the coat becomes dull and has a scabby eczematous appearance; necrotic patches about a couple of inches in diameter are produced, mostly under the breast and abdomen and on the limbs, and slough off leaving ulcers which refuse to heal. The conjunctiva is pale, sometimes yellowish in colour. There is increased lachrymation and pregnant females show a great tendency to abort, and are then often affected with retention of the afterbirth and uterine prolapse. If the mothers carry their calves to full time the milk secretion is so small that the calf born dies subsequently of starvation. Pregnant animals also frequently fall down and are unable to get up, being affected with paresis of the hind quarters. If the animals are unable to get up within 24 hours cardiac disturbances set in and they die.

Diagnosis of the disease was carried out by the injection of 1 c.c. of defibrinated blood from the affected animals intramuscularly into rats.

Post-mortem examination of buffaloes dead from surra shows no characteristic lesions. A gelatinous exudate was sometimes found in the subcutaneous and intermuscular connective tissue. There was in some cases a large quantity of serous exudate in the chest cavity. The lymphatic glands were always swollen and infiltrated with serous fluid; sometimes they contained minute petechiae. Petechiae are also observed under the epicardium and in the myocardium. Lesions in connection with the gastro-intestinal tract are also observed where digestive disturbances were noticed during life.

With the object of checking the spread of and suppressing the disease the Government authorities of the Dutch East Indies provide regulations for the closing of surra-infected pastures and prohibiting the export of infected cattle into clean districts. The author notes, however, that surra is enzootic throughout large low-lying districts especially along the coast, but that it is much rarer in the mountainous regions. In the infected districts one can thus only apply palliative measures taking specially into account the fact that feeding plays a very considerable part; mortality is highest during the rainy season when the sugar-canes are sown and when there is no stubble to turn the buffaloes out on to; in the dry season when the animals can find food on the harvested fields surra causes only sporadic losses. On the other hand, in horses losses from surra occur mostly during the dry season when they suffer more severely from the bites of Tabanidae and when they are turned out with the oxen on to the stubble.

MACFIE (J. W. SCOTT). **A Monomorphic Trypanosome of Man.**—*Report of the Accra Laboratory for the Year 1916.* pp. 60–66. With 1 coloured plate, 2 tables & 1 chart.

This article is of interest inasmuch as the trypanosome described showed a remarkable morphological resemblance to the commonly occurring trypanosome of domesticated animals in West Africa, viz., *T. vivax.* All the species and strains of trypanosomes that have hitherto been described as occurring naturally in the human blood have been of the polymorphic type, that is, they have shown long forms, shorter stumpy forms, and intermediate forms. In laboratory strains some of these organisms may in time become almost, if not quite, monomorphic, the long forms being very abundant and the stumpy forms rare or absent. Such strains must be regarded as abnormal, the result of a long series of inoculations into animals without the natural alternation in the insect host, and up to the present they have not been detected in nature.

The material used by Macfie in this study consisted of smears forwarded to him for examination from the blood of a native man at Tamale, Gold Coast. The history of the case suggested that the infection might have taken place about three weeks previously but apart from slight fever, which might not have been due to the trypanosomes, the patient had no symptoms of illness. After the first injection of atoxyl the trypanosomes disappeared and on subsequent examinations none could be detected. Two blood films were examined at different times while the parasites were discoverable in the blood and in both films a moderately heavy infection with trypanosomes was found. The living unstained organism was not examined by Macfie so that he was unable to give an account of its motility.

When fixed and stained the trypanosomes showed a characteristic appearance; all the individual elements were of similar shape and size. The shape of the body resembled that of *T. vivax* and showed an abrupt narrowing at the nucleus in front of which it tapered rapidly. The cytoplasm was clear showing an alveolar structure and granules were rarely found. The posterior end was usually blunt and not prolonged beyond the blepharoplast. The nucleus was long, oval, often rather diffuse, and sometimes divided into two or more pieces. The blepharoplast was large, rounded, and terminal or very nearly so. The undulating membrane was poorly developed and scarcely visible. The flagellum was well-developed and ran in most cases along the body in a gently curved line without deep undulations. There was always a long free portion to the flagellum.

The length of the trypanosome was slightly less than that of *T. vivax* and the range of variation was relatively small. Of 200 parasites measured the longest was 24μ, the shortest 18μ, average 20·7μ; these lengths were similar in the case of both films. These measurements indicate clearly the monomorphic character of the parasite.

TABLE I.

Measurements of Length of the Monomorphic Trypanosome found in the Blood of a Native of the Gold Coast.

Materials.	Number measured.	Lengths in microns.							Average lengths in Microns.
		18	19	20	21	22	23	24	
First specimen .	100	3	14	25	37	17	3	1	20·6
Second specimen .	100	1	13	23	39	16	5	3	20·8
Totals . .	200	4	27	48	76	33	8	4	—
Percentages .	—	2·0	13·5	24·0	38·0	16·5	4·0	2·0	20·7

In the remainder of this article Macfie discusses matter of such high veterinary importance that it is reprinted in full as follows :—

"The length of *T. vivax* varies from 18μ or 19μ to 28μ or 29μ. The measurements given by various observers working with different strains from widely separated countries all show a general similarity (see Table II). According to Bruce and his collaborators (1911), the Uganda strain of 1903 ranged from 20μ to 27μ in a series of 80 specimens measured, and the crest of the curve formed by plotting the lengths occurred at 24μ; the Uganda strain of 1909 showed a crest at 25μ and was on the whole similar excepting only for the occurrence of a few unusually small forms 16μ or 17μ in length; and the Cameroons strain of 1903, of which also only 80 individuals were measured, showed a crest at 23μ and a single unusually long trypanosome 31μ in length. The measurements of *T. vivax* made by Kinghorn and Yorke (1913), in Rhodesia ranged from 19μ to 29μ, and the curve reached its crest at 23μ; those made by me (1914) in Southern Nigeria ranged from 19μ to 28μ and showed the crest at 25μ; and a series from cattle on the Gold Coast (1915) ranged from 18μ to 29μ and their curve reached its highest point at 23μ. All these observations, therefore, agree in describing the length of *T. vivax* as having a restricted range varying from 18μ to 29μ, except in rare instances, and the curves formed by distributing the measurements show a decided peak at a length varying from 23μ to 25μ.

TABLE II.

The Distribution, by percentages, according to length of Various Strains of *Trypanosoma vivax.*

Strain.	Lengths in Microns.																
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Average.
Uganda, 1903 (Pordage's ox). S. S. C.	—	—	—	—	2·5	3·7	22·5	22·5	30·0	15·0	2·5	1·3	—	—	—	—	23·3
Uganda, 1909. S. S. C.	0·6	1·1	—	1·1	2·2	1·7	6·1	11·6	19·5	24·4	22·2	6·7	1·7	1·1	—	—	24·4
Cameroons, 1903. S. S. C.	—	—	1·2	2·5	6·3	10·0	12·5	17·5	10·0	13·7	11·3	11·3	2·5	—	—	1·2	23·7
Rhodesia, 1912. Kinghorn and Yorke.* ..	—	—	—	1·5	2·5	8·5	16·0	22·5	18·0	14·5	9·5	4·5	2·0	0·5	—	—	23·63
Southern Nigeria, 1914. Macfie	—	—	—	1·0	4·0	4·0	13·0	19·0	23·0	27·0	4·0	3·0	2·0	—	—	—	23·74
Gold Coast, 1915. Macfie	—	—	1·0	2·0	5·0	12·0	18·0	29·0	18·0	9·0	3·0	2·0	—	1·0	—	—	22·64

* These authors do not record the actual figures, those given here are taken from their Chart.

"On comparing these measurements with those of the monomorphic trypanosome found in man it is evident that *T. vivax* is slightly the larger organism. In the human parasite the minimum length was about the same as that of *T. vivax*, but the longest individuals did not exceed 24μ, whereas *T. vivax* not infrequently measures 28μ or 29μ, and according to Bruce may even reach 31μ. The most common length—that is, the situation of the crest of the curve—was also different, viz., 21μ instead of 23μ to 25μ; and the average length, $20{\cdot}7\mu$ was less than that of any of the strains of *T. vivax*.

"The most detailed study of the length of *T. vivax* is, however, that of Blacklock (1912), which has not been referred to above on account of the difficulty of including his measurements in the table given. This author measured the length of 1,000 trypanosomes in goats at the Runcorn Research Laboratories, the strain being one isolated from a horse sent to Liverpool from the Gambia by Professor Todd. The longest of these trypanosomes measured $26{\cdot}7\mu$, the shortest $15{\cdot}5\mu$, and the average worked out at $21{\cdot}7\mu$; 57·8 per cent. of the parasites measured between 20μ and 23μ. In the chart compiled by Blacklock from his measurements, the crest of the curve occurs at $22{\cdot}5\mu$. To these measurements of *T. vivax* those of the monomorphic human trypanosome approximate more closely than they do to any of those previously referred to; and as in one of Blacklock's groups of 100 parasites the average length was $20{\cdot}9\mu$, there cannot be said to be any appreciable difference between the lengths of the two organisms.

"Another trypanosome, *T. uniforme*, resembles in some respects the human parasite found in the Gold Coast. This organism was discovered by Bruce and his collaborators (1911) in Uganda in the blood of oxen, and was described as resembling *T. vivax* closely but differing from it 'in size, and perhaps to a slight extent in shape.' This trypanosome measured in length from 12μ to 19μ, and averaged 16μ; and the crest of the curve representing the distribution of 200 individuals in respect to length was at 16μ. *T. uniforme* was therefore a smaller organism than the monomorphic trypanosome described in the paper, although in general appearance it resembled it closely.

"The third trypanosome usually included in the same group as *T. vivax* is *T. caprae*, a parasite discovered by Kleine in goats in the neighbourhood of Lake Tanganyika. Kleine (1910) described this trypanosome as being larger than *T. brucei*, and stated that some forms had, others had not, a free portion to the flagellum. Bruce (1913) and his fellow investigators subsequently studied this organism in Nyasaland, and measured 500 individuals (taken from various animals) which ranged in length from 32μ to 18μ, averaged $25{\cdot}5\mu$, and formed a curve similar to that of a monomorphic trypanosome with a peak at 25μ. They considered that '*T. caprae* differs from *T. vivax* in that it is heavier built and altogether has a larger and clumsier appearance,' and they denied the statement made by Kleine that some forms were without a free flagellum. So far as the actual measurements of length are concerned, there is no great difference between *T. vivax* and *T. caprae*, and it may be doubted if they could be separated by this character; it may be pointed out also that the difference in size between *T. vivax* and the monomorphic human trypanosome is greater than that between *T. vivax* and *T. caprae*. . . . Bruce noted as a curious fact that *T. uniforme* and *T. vivax* had not been met with by the Commission in Nyasaland, and suggested that this might be due 'to the absence of *Glossina palpalis*, which is their carrier, while *T. caprae* is carried by *G. morsitans*.' Kinghorn and Yorke however have shown that *T. vivax* is carried also by *G. morsitans*. It is not improbable, therefore, that *T. caprae* may be only a variety of *T. vivax*.

"The trypanosome found in the blood of this native of the Gold Coast appears to be intermediate between *T. vivax* and *T. uniforme* as regards its morphology. All three organisms have the same general form, but *T. vivax* is the longest, *T. uniforme* the shortest, and the Gold Coast trypanosome occupies an intermediate position nearer to *T. vivax*, however, tha to *T. uniforme*. . . .

"From the very small amount of materials available, and in the absence of any observations on the pathogenicity of the strain to animals, it is impossible to decide the species of this trypanosome, but morphologically its similarity to *T. vivax* is very striking.

"Neither *T. uniforme* nor *T. caprae* has hitherto been identified in the Gold Coast, but *T. vivax* is an exceedingly common parasite of domestic animals in West Africa, and was found in no less than 76 per cent. of the hump-backed cattle examined by me at Accra (1914). It would therefore be a serious matter if this species were proved to be pathogenic to man. *T. vivax* is not pathogenic to monkeys, and has been regarded as harmless to man, an assumption which is strongly supported by the fact that a human infection has never yet been recorded, although the organism is widely distributed and very abundant in Africa. Blacklock and Yorke (1913), however, succeeded in rendering a strain of *T. vivax* pathogenic to rabbits, which are usually immune, and in the same way other refractory animals may become infected. It is possible, therefore, that occasionally, under abnormal conditions, this trypanosome might succeed in infecting man or might transiently appear in his blood, for it is transmitted by the bites of tsetse flies (*G. palpalis*, *G. morsitans*, and *G. tachinoides*) to which the natives of the Gold Coast are constantly exposed. It should be mentioned in this connection that Blacklock and Yorke examined the strain of *T. vivax* they used after it had been passed through six generations of rabbits, but that they failed to detect in it any morphological changes. In this case, then, no structural modifications appeared to accompany the alteration in pathogenicity which enabled the trypanosome to infect an unusual host.

"The description of this organism, incomplete though it is, is put on record in order to draw the attention of future workers in the Gold Coast to the fact that there is in West Africa a species of monomorphic trypanosome capable of infecting man."

BRUGGEMAN (J. P. I.). **Anaplasmose bij Buffels (voorloopige mededeeling).** [Anaplasmosis in Buffaloes. Preliminary Communication.] —*Veeartsenijkundige Bladen v. Nederl.-Indië.* 1917. Vol. 29. No. 2. pp. 175–181.

This note deals with a serious outbreak of disease which first appeared among buffaloes in the district around Rembang on the northern coast of Java, Dutch East Indies. The mortality rose to 28 out of 200 in the first affected centre. Blood smears taken from the animals first affected showed an excessive number of trypanosomes and as the symptoms shown consisted in an excessive flow of saliva, swelling of the limbs, anaemia, varying temperature and emaciation the disease was first diagnosed as surra. However, from time to time smears taken from animals showing manifest clinical symptoms showed no trypanosomes; hence the presence of another disease was suspected, especially on account of the high mortality. Besides, it is stated by this author that surra always runs a chronic and favourable course in buffaloes. Eruptions and desquamation of the skin together with severe diarrhoea were observed in addition in the affected animals.

The disease was later found to have become widespread in other districts and examination of blood preparations from these places always gave negative results as to the presence of trypanosomes; inoculation of the small experimental animals likewise gave negative results. A more careful examination of blood smears after staining with Giemsa and Leishman was then resorted to and these showed the presence of red corpuscles in good condition showing especially at their margins a number of darkly staining points. In rare cases these points were situated towards the centres of the corpuscles. The disease was thus diagnosed as being due to *Anaplasma marginale*. The blood of affected animals, especially when the disease was of several days standing, invariably presented this appearance. Towards death the bodies became greater in number and at the same time peculiar degenerative appearances were seen in the interior of the corpuscles in the form of rounded or crescentic colourless spots or cavities which appeared as if they had previously enclosed the parasites; poikilocytosis and anisocytosis and other anaemic changes were then seen.

According to the author the disease in Java could be recognised by the following symptoms:—

(1) A profuse green watery diarrhoea containing no blood or mucus.

(2) A skin eruption which gives the animal a mildewed appearance or as if it was covered with fine wire netting. The crusts originate with the formation of small vesicles especially on the back, lo ns, and croup. These burst and foim a white scurf which on falling off leaves behind an unpigmented patch of skin. About the base of the ears especially long furrows oozing blood may be thus formed. This mildewed appearance generally begins two or three days before the onset of severe diarrhoea and the refusal of food.

(3) Sunken eyes with a watery, sometimes a little muco-purulent, discharge; always very marked photophobia with blinking of the eyes.

(4) Temperature as a rule between 100·4 F. (38° C.) and 101·4° F. (38·7° C.); the muzzle is not dry.

The disease was never observed affecting cattle. No ticks were found in spite of a careful search. Exceptionally a few buffaloes recovered but the great majority died in from two to five days after the onset of diarrhoea with marked emaciation. It is stated that this mortality due to the *marginale* agrees with the finding of THEILER that this variety produces a virulent form of the disease while the *centrale* sets up a milder form.

The bodies found within the corpuscles were distinguishable from degenerative formations (*Randkörnchen*) inasmuch as the latter stained of an azure-red colour; no piroplasms were discoverable.

A longer report is promised when the author has been able to consult the literature and finish a number of experiments he has in hand concerning the disease.

PRICOLO (Antonio). **Classificazione della piroplasmosi tunisina.** [Classification of Tunisian Piroplasmoses.]—Reprint extracted from *Moderno Zooiatro* 1915. 2 pp.

In this note Pricolo reproduces some correspondence which took place between him and THEILER regarding some preparations sent to the latter for examination. "The parasites found in the smears were indistinguishable from those found in the blood of cattle affected with East Coast fever in South Africa and in particular the presence of Koch's blue bodies left no room for doubt but that the organism was *Piroplasma parvum*."

The blood from affected animals failed to infect susceptible animals by direct inoculation and the progeny of ticks fed on infected cattle were found to be innocuous. Sardinian cattle were found to show visible symptoms within about 20 days after contact with infected Tunisian cattle. Imported Italian cattle often revealed the presence of *Piroplasma bovis* in their blood.

STEFKO (W.). **Piroplasmose et Anaplasmose en Turquie (1916).** [Piroplasmosis and Anaplasmosis in Turkey, 1916.]—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 723–724.

Several cases of the above diseases were observed in oxen imported from Russia into Turkey (Trebizond, Platana, and Rizeh, etc.) during the summer of 1916. The mortality produced was very high (80–90 per cent.). The parasites found in smears from the spleen belonged to *Piroplasma bigeminum, annulatum* and to *Anaplasma centrale.*

Infection with both parasites was very common. The intermediate host was *Boophilus annulatus.* The eggs of this tick were infected to a very large extent with piroplasms. *Ixodes corniger* Kol. and *Rhipicephalus simus* Koch were not so commonly found in this region.

FRANÇA (Carlos). **Sur la classification des hémosporidies.** [Classification of the Haemosporidia.] — Reprint from *Jl. de Sciências Matemáticas, Fisicas e Naturais.* Series 3. No. 1. 41 pp. With 29 text figs. & 1 table. 1917. Lisbon : Imprensa Nacional.

"In the classification of *Haemocytozoa* or *Haemosporidia* the greatest confusion still exists and it is thus desirable to revise their classification. The confusion arising in connection with the systematic position of these protozoa is undoubtedly due to the very strict parasitism of these cytozoa. This permanent parasitism impresses on the different forms a particular aspect which renders a systematic classification difficult; but at the same time the peculiarities of this parasitism tends to justify the adoption of the order *Haemosporidia* to which Mesnil, in a recent work, denies any taxonomic value.

"In our opinion one should consider as belonging to the *Haemosporidia* only those coccidiform protozoa adapted to intra-corpuscular life.

"The *Haemosporidia* constitute one of the sub-orders of *Sporozoa* and may be characterised thus:—

"Protozoa living in the blood corpuscles, either in the red corpuscles or in the leucocytes; possessing a schizogonic phase in the body of the vertebrate and a sporogonic phase in the invertebrate. The invertebrate in which is passed the sexual cycle of the protozoon and which represents its primitive host is the transmitting agent of these forms.

"The sub-order *Haemosporidia* constitutes with the sub-order *Coccidia,* the order *Coccidiomorpha.*

"The French parasitologist Mesnil, in the work above referred to, states: 'França speaks of the order of *Haemosporidia.* He means to convey, no doubt, by this term the re-union of three families—*Plasmodiidae* (or *Haemamoebidae*), *Haemogregarinidae,* and *Piroplasmidae.* I believe that in the actual state of our knowledge, such a grouping is no longer possible.'

"Mesnil bases this statement on the fact that the *Haemosporidia* present sexual phenomena which vary markedly according to the families considered: of the type *Adelea* (*Haemogregarina*), of the type *Eimeria* (*Plasmodidae*), or of a type intermediate between these two (*Piroplasmidae*), and also inasmuch as they constitute 'a heterogeneous collection which have no characters in common except the general characters of the Coccidia.'

"We cannot follow Professor Mesnil in these conclusions. We believe simply that one has to recognise common ancestral forms in the origin of *Coccidia* and *Haemosporidia* and that this explains the analogy and even the identity existing between the multiplication phenomena of the forms belonging to these two sub-orders.

"The *Haemosporidia* must, in addition, represent the most recent *Sporozoa*; several of these forms are still tentatively adapting themselves to the vertebrate body, and this is manifested by their pathogenicity, which always signifies a lack of harmony, the result of incomplete adaptation.

"The common ancestors and identical conditions of life (intracellular habitat) impresses on the two sub-orders of *Coccidiomorpha* a certain number of common characters.

"We thus accept the sub-order *Haemosporidia*, which in the classification of protozoa should have the following place:—

Class.	Sub-class.	Order.	Sub-order.
"Sporozoa	Telosporidia	Gregarinida	
		Coccidiomorpha	Coccidia
			Haemosporidia
	Neosporidia		

"The sub-order *Haemosporidia* comprises four families:—

"1. *Haemogregarinidae.*
"2. *Plasmodidae.*
"3. *Piroplasmidae.*
"4. *Toxoplasmidae.*"

The bases for the classification of the haemosporidia into four families are indicated in the accompanying table opposite.

1. Fam. *Haemogregarinidae* Neveu Lemaire, 1901.

(a) Genus *Haemogregarina* Danilewsky, 1885. (Syn.: *Drepanidium* Lankester, 1882 pro parte; *Karyolysus* Labbé, 1894; *Danilewskya* Labbé, 1894.)

"Vermicular non-pigmented haematozoa living within the blood corpuscles. Schizogony within cysts in the internal organs,—either within the corpuscles (Haemogregarines of tortoises, snakes, and fishes) or outside the corpuscles (Haemogregarines of mammals and lizards)."

A list of 225 species together with their hosts and geographical distribution is given.

(b) Genus *Hepatozoon* Miller, 1908. (Syn.: *Leucocytozoon* Danilewsky, 1889, pro parte; *Leucocytogregarina* Porter, 1909.)

"Vermicular haematozoa without pigment and living within leucocytes. Schizogony inside cysts within the internal organs, sometimes in the cells of the organ.

"All forms hitherto described have been found in mammals."

A list of 22 species is given; the most important one appears to be *H. canis* Bentley and James, 1905, found in the dog in India, Australasia, and Africa.

2. Fam. *Haemamoebidae* Ross, 1889. (Syn.: *Plasmodiidae* Lühe, 1906.)

(a) Genus *Plasmodium* Marchiafava and Celli, 1885. (Syn.: *Polychromophilus* Dionisi, 1898.)

"Pigmented haemamoebidae in which the gametocytes are identical with the schizonts. Schizogony in the peripheral blood."

					Genera.	Families.
Haemosporidia inhabiting	the blood	Non-pigmented.	Without flagelliform microgametes.	Schizogony in the interior of cysts in theinternalorgans.	*Haemogregarina* Danilewsky, 1885.	*Haemogregarinidae* Neveu - Lemaire, 1901.
					Hepatozoon Miller, 1908.	
				Schizogony within the corpuscles of the circulating blood or in the interior of the internal organs.	*Piroplasma* Patton, 1895.	*Piroplasmidae* França, 1909.
					Smithia França, 1909.	
					Nuttallia França, 1909.	
					Theileria Bettencourt and Borges, 1907.	
					Paraplasma Seidelin, 1912.	
					Achromaticus Dionisi, 1900.	
					Rangelia Carini and Maciel, 1914.	
					Rossiella Nuttall, 1910.	
					Elleipsisoma França, 1910.	
			Flagelliform microgametes.	Schizogony in the internal organs.	*Leucocytczoon* Ziemann, 1898.	*Haemamoebidae* Ross, 1899.
		Pigmented	Flagelliform microgametes.	Schizogony in the corpuscles in the circulation or in the internal organs	*Plasmodium* Marchiafava and Celli, 1885.	
					Laverania Grassi and Feletti, 1889.	
					Haemoproteus Kruse, 1890.	
					Proteosoma Labbé, 1893.	
					Haemocystidium Castellani and Willey, 1904.	
	the organs	Non-pigmented	Without flagelliform microgametes.	Schizogony in the interior of cells.	*Toxoplasma* Nicolle and Manceaux, 1908.	*Toxoplasmidae* n.f.

A list of 28 species is given, including the causal agents of human tertian and quartan malarial fever, and *P. canis* Castellani and Chalmers, 1908, found in the dog in Ceylon.

(b) Genus *Laverania* Grassi and Felletti, 1889.

"Pigmented haemamoebidae in which the gametocytes (crescentic-shaped bodies) are different in shape from that of the schizonts. Schizogony within the blood corpuscles in the internal organs."

This genus comprises only one species, viz., *L. malariae* (or *Plasmodium falciparum*), the causal agent of tropical malarial fever in man.

(c) Genus *Haemoproteus* Kruse, 1890 (= *Halteridium* Labbé, 1894).

"Pigmented amoeboid dumb-bell shaped Haemamoebidae which surround but do not displace the nucleus of the corpuscle. Schizogony in the internal organs. Exceptionally, schizogony in the circulating blood. Two groups of merozoites at each pole of the dumb-bell."

A list of 18 species found in birds, including the well-known Haemoproteus of the pigeon, is given, and also a long list of various species of birds in which the parasites have been found in different parts of the world; three species are known to occur in tortoises and snakes.

(d) Genus *Proteosoma* Labbé, 1893.

"Pigmented Haemamoebidae, generally displacing the nucleus of the invaded corpuscle. Schizogony in the circulating blood. Merozoites arranged around a residual body."

Twelve species are enumerated, including the Proteosoma of the common sparrow.

(e) Genus *Haemocystidium* Castellani and Willey, 1904.

"Pigmented Haemamoebidae which in their adult stage are oval or rounded in shape (never amoeboid), with a perfectly regular contour, vacuolated cytoplasm, and an almost invisible nucleus. Very marked sexual dimorphism. The nucleus of the corpuscle is at a very early stage pushed towards one of the extremities of the corpuscle. Schizogony in the circulating blood by means of binary or quaternary division."

Three species of no great importance are mentioned.

(f) Genus *Leucocytozoon* Ziemann, 1894.

"Non-pigmented Haemamoebidae living in the corpuscles in which they produce marked changes in appearance. Very distinct sexual dualism. Gametes rounded (type B), or oval (type A), producing in the latter case a peculiar deformity of the corpuscles, viz. two tapering polar expansions. Schizonts in the internal organs where schizogony takes place. Flagelliform microgametes. Large, elongated, non-pigmented ookinete."

A large number of species of both types have been described in birds and 42 species are enumerated in this paper, including *L. anatis* Wickware, 1915 (type A), found in the duck in Canada.

Fam. *Piroplasmidae* Franca, 1909.

(a) Genus *Piroplasma* Patton, 1895 (= *Haematococcus* Babes, 1888; *Pirosoma* Smith and Kilborne, 1893; *Babesia* Starcovici, 1893; *Apiosoma* Wandolleck, 1895).

"Haematozoa showing during one of their stages a pear-shaped form and arranged in pairs within the same corpuscle. Division takes place by a process of gemmation."

This genus contains some of the most important Haematozoa of the domesticated animals. Eight species are given, of which the following are the more important :—

Species.	Host.	Intermediate host.	Distribution.
P. bovis Babes, 1888.	Bovines.	*Boophilus annulatus, australis* and *decoloratus.*	North and South America, Australia, Asia and Africa.
Synonym : *P. bigemina* Smith and Kilborne, 1893.	Bovines.		America.
P. divergens McFadyean & Stockman.	Bovines.	*Ixodes ricinus.*	Europe.* (In Portugal the disease caused by this species is called *ferrujão.*)
P. ovis Starcovici, 1893.	Sheep.	*Rhipicephalus bursa.*	Italy, Turkey, Roumania and Transcaucasus.
P. canis Piano & Galli-Valerio, 1895.	Dog.	*Rhipicephalus sanguineus, Haemaphysalis leachi.*	The whole world.
P. caballi Nuttall, 1910.	Horse.	*Boophilus annulatus, Dermacentor reticulatus.*	Russia, Roumania, Transcaucasus, Siberia.

(b) Genus *Smithia* França, 1909.

"Haematozoa showing during one of their stages a pear-shaped form. The majority of the pear-shaped parasites occupy the whole diameter of the corpuscle and are not arranged in pairs. Multiplication by division into four (in the shape of a cross)."

Two unimportant species are at present known.

(c) Genus *Nuttallia* França, 1909.

"Oval, more rarely pear-shaped haematozoa. Multiplication forms in the shape of a cross. The elements composing the cross possess a relatively abundant protoplasm. No rod-shaped elements."

Eight species are enumerated, one of which, viz., *N. equi* Laveran, 1899, is pathogenic for the horse and is found in Italy, Africa, Transcaucasus, India, Annam, Brazil; intermediate host, *Rhipicephalus bursa.* "The disease caused by this piroplasm has been called Nuttalliasis, and is more severe than that due to *P. caballi* (Carpano)."

(d) Genus *Theileria* Bettencourt, Franca, & Borges, 1907.

"Rod-shaped haematozoa which on division give rise to elements taking the form of a cross. The elements of the cross are very small, rounded, and almost exclusively composed of chromatin."

"This genus contains pathogenic species, some of which are of great economic importance on account of the mortality they produce among cattle."

* From this table the reader might be led to believe that *P. divergens* was the only piroplasm found affecting cattle in Europe. Attention is, however, called to McFadyean and Stockman's original article, in which they state :—

"We have also satisfied ourselves that the piroplasma bigeminum is a cause—we think probably the common cause—of redwater in Great Britain, and for purposes of comparison we give here (fig. 1 and fig. 2) illustrations respectively of an English strain of the piroplasma bigeminum and of the piroplasm which we hold to belong to a different species" (*Jl. Comp. Path. and Ther.*, 1911. Dec. Vol. 24. Part 4. p. 340).—Ed.

Of the 10 species enumerated the following appear to be the more important:—

Species.	**Host.**	**Intermediate host.**	**Distribution.**
Theileria annulata Dschunkowsky, 1904.	Bovines.		Russia.
T. parva Theiler, 1904.	Bovines.	*Rhipicephalus appendiculatus, R. simus, R. evertsi, R. nitens, R. capensis.*	Africa (producing the diseases known as East Coast Fever, Rhodesian "red-water," *Amakebe* in Uganda, Mediterranean Coast Fever (Carpano).
T. mutans Theiler, 1907.	Bovines.	*R. simus, R. evertsi.*	Africa (at one time alleged to be the cause of gall-sickness).
T. dama Bettencourt, França and Borges, 1907.	*Cervus dama.*		Portugal.
T. hippotragi Todd & Wolbach, 1912.	*Hippotragus equinus.*		Africa.
T. stordii França, 1912.	*Gazella grantii.*		Abyssinia.
T. ovis Rodhain, 1916.	Sheep.		Africa.

(e) Genus *Paraplasma* Seidelin, 1912.

"Rod-shaped elements as in the case of *Theileria*. Ring-shaped forms as in the case of *Plasmodia*. Schizogony in the capillaries of the internal organs especially in the kidneys."

One species has been described, viz., *Paraplasma flavigenum* Seidelin, the alleged causal agent of yellow fever in man (intermediate host *Stegomyia calopus*).

(f) Genus *Achromaticus* Dionisi, 1900.

"Sickle-shaped, pear-shaped, or rounded elements. Schizogony within the red corpuscles usually giving rise to numerous merozoites. Very elongated forms may occupy the whole diameter of the corpuscle."

This genus contains one species found in different species of bats, and another of importance—*A. gibsoni* Patton, 1910, inasmuch as it has been alleged to be pathogenic for sporting dogs (*Canis aureus*) in Madras.

(f) Genus *Rangelia* Carini and Maciel, 1914.

"Rounded, oval, or pear-shaped forms arranged most frequently in pairs. Schizogony in the protoplasm of the connective tissue and endothelial cells of the internal organs producing a very large number (30 to 100) of merozoites."

One species only is known, viz., *Rangelia vitalli* Rangel Pestana, 1910, a disease-producing organism of dogs in Brazil. The disease caused by this protozoon is known as *Nambiuvù.*

(g) Genus *Rossiella* Nuttall, 1910.

"Very large, usually rounded haematozoa. Rounded nucleus. Schizogony in the interior of the corpuscles by means of binary division, which may be repeated a certain number of times, thus producing a rather variable number of large merozoites."

One species only is known, viz., *Rossiella rossi*, Nuttall, 1910, parasitic in *Canis adustus* (Africa).

(h) Genus *Elleipsisoma* França, 1910.

"Elliptical or oval non-pigmented forms living within the corpuscles which become deformed and deprived of haemoglobin. Relatively large nucleus usually placed close up to one of the margins of the haematozoon. Schizogony and binary division in the lung."

This genus contains one species found in moles in various countries in Europe.

4. Fam. *Toxoplasmidae* n.f.

This family contains one genus *Toxoplasma* Nicolle and Manceaux, 1908.

"Oval or kidney-shaped protozoa which reproduce by longitudinal division or by multiple division in the interior of the invaded cells. Found in the mononuclears and polynuclears in the spleen and other organs, and, exceptionally, in the blood."

This genus comprises already thirty known species some of which are extremely pathogenic, the latter including *Toxoplasma cuniculi* Splendore, 1909, pathogenic for the rabbit (*Oryctolagus cuniculus*) in Brazil and *T. canis* Mello, 1910, pathogenic for the dog in Italy, Germany and Brazil. Another species *T. pyrogenes* Castellani, 1914, has been incriminated as the cause of chronic fever in man in India and the Black Sea Coast.

"There are found among the Haemosporidia certain genera whose systematic position has not yet been determined on account of our lack of knowledge concerning certain peculiarities in their biology.

"The genera *Immanoplasma, Toddia, Microsoma,* and *Pirhemocyton* belong to this category, but they, however, possess certain characters in common which enable one to group them together."

These genera comprise only a few species of no economic importance and thus the description of their characteristics is omitted from this extract.

There are still a number of Haematozoa which on account of their nuclear dimorphism seem to be closely connected with the flagellates. This has been proved in the case of Leishmania and thus these organisms are excluded from the Haemosporidia. The same has not yet been shown in the case of the genera Dactylosoma, Nicollia, and Endotrypanum, and thus although França gives the characters by means of which they can be identified he is convinced that some of them must later be removed from the order Haemosporidia.

DISEASES DUE TO METAZOAN PARASITES.

WIRTH (D.). **Filariosen bei einheimischen Pferden (Vierte Mitteilung).** [Filariasis in Native (Hungarian) Horses, Fourth Report.]—*Zeitschr. f. Infektionskr. parasit. Krankheit. u. Hyg. d. Haustiere.* 1917. June. Vol. 18. Nos. 4 & 5. pp. 380–413. With 4 plates comprising 10 figs.

In reports published 1911–1913 the author dealt with the question of the presence of microfilariae in the blood of Hungarian horses, and principally with the clinical symptoms observed. The present paper is concerned with the morphology and biology of the parasites and their further development into what is considered as the adult stage.

The affected animal used for these studies was a four-year old horse bred at a military stud where numerous cases of filariasis had occurred especially during the preceding summer. The horse was kept under clinical observation for four months (May-August, 1914); during this period the temperature was slightly subnormal, breathing 10 to 16, and pulse 30 to 40 per minute, heart-beats irregular, intermittent after every four beats, and heart action very violent on slight exertion; the appetite was somewhat depraved but otherwise the horse ate well and its general condition was good. The urine was normal and no microfilariae were found in the sediment. From 1 to 3 microfilariae were found in each drop of blood. Blood examination gave the following figures:—haemoglobin, 97·5° (estimated by SAHLI's method); red corpuscles, 11,158,000; white corpuscles, 13,376; proportion between red and white corpuscles, 1 : 804; lymphocytes, 30·8 per cent.; polynuclear leucocytes, 60 per cent.; eosinophiles, 5·2 per cent. (4–8·3 per cent.); mononuclears and transition forms 4 per cent.

Clinical symptoms of microfilariasis in the horse.—The following is a summary of the author's previous reports. Filariasis appears generally during the hotter part of the year. Hitherto young animals (foals) more especially have been found affected; the oldest was eight years old. The body temperature was usually subnormal or sometimes very slightly above normal. The affected animals show general lassitude and a somewhat diminished appetite which is occasionally temporarily increased. The most noticeable symptom is the rapid exhaustion of the animal at work, thus rendering riding horses useless. It is not decided whether the irregularity in the action of the heart shown in some animals is a characteristic symptom. The sudden collapse of the animal especially in the stable is a further symptom. MANDEL was of opinion that the nematode worm found in the eyeball of horses affected with moon-blindness was probably connected with filariasis. None of the author's cases was simultaneously affected with moon-blindness and in a military stud where moon-blindness was not uncommon no microfilariae were found in the horses so affected. As a rule the disease was found to last from three months up to a year. The number of parasites in a drop of blood was found usually to vary between one and six, but sometimes the number might drop down to one in every five or ten drops of blood and occasionally single specimens only could be found after prolonged searching. In all cases, however, marked eosinophilia was discoverable; whilst in normal horses the proportion of eosinophiles is about 3 per cent. in filariasis they may increase up to over 8 per cent. An appreciable leucocytosis was not observed and the number of red corpuscles and the haemoglobin content were approximately normal. Leucocytosis and anaemia on the other hand are common in canine filariasis. The percentage of lymphocytes was with one exception high, thus corresponding with YAKIMOFF's observations regarding filariasis in Turkestan. Microfilariae may be present in the blood of horses showing no apparent symptoms of disease.

The author holds that the microfilariae were responsible for the clinical symptoms inasmuch as (1) no other causes were discoverable, (2) where observation was continued over a long-enough period it was found that a complete recovery set in after the disappearance of the microfilariae from the blood, (3) other authors describe similar conditions in man as well as other animals caused by microfilariae. In those cases where microfilariae are found in apparently healthy horses they are very few in number and not always present.

The disease generally runs a favourable course but recovery generally takes a long time,—several weeks or months. In the author's cases recovery seemed to be complete, at least no recurrence was observed.

The author is of opinion that no drugs are beneficial in the treatment of affected animals, recovery taking place naturally in two to four months. Atoxyl administered in from 1 to 2 gramme doses subcutaneously gave negative results.

Technique of examination for microfilariae.—Blood for testing is best taken by puncturing the facial vein; the necessary amount of blood may also sometimes be obtained by incising the mucous membrane of the lips; large quantities if needed are taken from the jugular vein. Thick smears are usually necessary and the cover glass used should be somewhat larger than those ordinarily employed.

The simplest method of detecting the parasites is by the examination of fresh preparations between slide and cover glass under a low power of the microscope; in certain cases an oil-immersion lens is required combined with a dark ground illumination.

Another good method for detecting and also for counting the parasites consists in spreading a large drop of blood on a slide, allowing to dry and then getting rid of the haemoglobin by placing in distilled water. The thin grey film remaining is fixed in alcohol for a few minutes, washed and stained with haematoxylin. Before examination the smears are covered with a layer of cedar wood oil in order to increase their transparency.

The cellular structure is best made out by employing Looss's method. The cover glass is smeared with a thick layer of blood and placed wet side downwards for two or three minutes in 70 per cent. alcohol kept at 60° C. The smears may be preserved in 70 per cent. alcohol for a long time. Before staining, the preparations are put through increasing concentrations of alcohol. They are then stained with haematoxylin, dehydrated in alcohol, clarified in oil of bergamot, and mounted in Canada balsam.

Intra-vitam staining with a solution of azur II. in distilled water (1 : 3,000) is suitable for the study of the internal organs of the parasite. A drop of blood and a drop of the staining solution are mixed together on a slide and covered with a cover-glass. The microfilariae remain alive for some time but take on the colour. All these methods are surpassed by the following processes lately introduced by FÜLLEBORN, viz. :—

(*a*) Azur-eosin stain. The freshly dried, not too thick, smears on cover glasses are stained for 1½–3 hours in a solution composed of 4 c.c. of alkaline 1 per cent. azur II. solution + 100 c.c. of 0·9 per cent. salt solution. The preparations are then placed in a 1 per cent. solution of eosin in a 0·9 per cent. salt solution for 10 minutes. The preparations must only be allowed to remain in the first solution until the bodies of the parasites acquire a light blue tinge.

(*b*) Carbol-methyl-green-pyronin stain. The freshly dried smears are placed for one to two minutes into 0·9 per cent. salt solution and then for half-an-hour or longer in carbol-methyl-green-pyronin (PAPPENHEIM-UNNA) to which one-tenth of its volume of 0·9 per cent. salt solution has been added. The preparations are then differentiated in 10 per cent. alcohol for 10 seconds, in 30 per cent. for 10 seconds, and in absolute for 20–30 seconds. They are then clarified in oil of bergamot and mounted in Canada balsam.

For counting the number of microfilariae in blood 20 cmm. is taken as a standard measure in the case of human beings, but, as the number of parasites is not generally so numerous in horses, the author used a larger quantity (100 cmm.). This quantity was sucked up into a pipette, placed on a slide and spread into an even layer by means of a knife. The preparations were dried and stained according to the method used for counting described above.

A method of concentrating the parasites consists in taking a moderately large quantity of blood from the jugular vein, defibrinating and centrifuging at a high speed for two hours or more. The microfilariae are found in the layer between the serum and the red corpuscles.

The measurements were taken by means of an ocular micrometer and an oil immersion lens. They were only approximately accurate in the case of living specimens.

The diagnosis of the parasites is made by examining fresh preparations or stained smears freed from haemoglobin. If numerous, parasites may be detected in the first smear examined but otherwise a large number (at least 10) must be repeatedly searched. In such cases the concentration process should be used.

Morphology and biology of the microfilariae.—In fresh preparations the parasite is seen as an elongated white small worm about the width of a red corpuscle and about 50 times as long. It executes very lively, snake-like movements between the corpuscles, sometimes becoming coiled into a spiral-like shape and sometimes straightening itself out. It is often difficult to keep within the field of the microscope even under a low power. The measurements can only be determined during a period of rest; the length is about 250 to 290 microns and the width 5 to 7 microns; dead parasites are always shorter owing to shrinkage. The anterior extremity is blunted and the posterior drawn out and pointed in appearance. The body is of uniform width along the part extending between the anterior tenth and the end of the third quarter of its length. The posterior quarter tapers to a fine thread-like extremity. Under a high magnification and with the use of dark ground illumination the granular body substance is seen to be surrounded by a narrow lighter zone which is the envelope representing, according to some authors, the covering of the embryo. No adhesion to the slide as seen in many other microfilariae was observed. In dried preparations freed from haemoglobin the microfilaria is seen under a low power as a thread-like coiled-up body staining dark blue; in some cases the envelope is seen to protrude in front and behind as a delicate faintly stained shred. The coiling of the body presents no special characteristics.

Dry fixation and staining with Giemsa is not suitable for showing the structure of the organism owing to shrinkage. This is better seen by the use of Looss's method; the body then generally takes up a straightened out appearance and the dark blue body is seen to be surrounded with a sheath which is easily recognisable owing to its protruding in front and behind. The body is found to consist of a large number of regularly arranged granules which are interrupted in three distinct places by transparent areas free from granules.

The stained organism is found to be shrunk so that it now measures 150 to 240 microns, the sheath protruding anteriorly by about 6 to 16 microns and posteriorly by about 20 to 40 microns. Shrinkage occurs after the employment of every method, especially after dry fixation, but least of all in FÜLLEBORN's method. According to RODENWALDT the dark granular appearance of the body is an artefact produced owing to the strong staining affinities of the cells lining the intestinal tract thus masking the appearance of the other organs. In this granular mass of deeply stained intestinal cells only three gaps are plainly visible which represent the nervous centre or nerve ring (N.), the excretory pore (Ep.) and the genital or anal pore (Gp.).

The nerve ring is situated towards the anterior part of the body and runs across it obliquely in the form of small stripes. The excretory pore lays at the junction of the anterior and middle third of the body, and the genital pore in the posterior third of the body; the excretory pore is larger than the genital pore; each takes up about half the width of the organism. In order to study the finer details it is advisable to adopt intra-vitam staining or FÜLLEBORN's method of staining and examine a considerable number of specimens—which is difficult on account of their sparsity in horses—as the complete details cannot as a rule be observed in the case of a single specimen.

Excretory organ.—Under an oil immersion lens one may observe that the stain is taken on comparatively deeply at the junction of the anterior and middle third of the body and spreads out in a backward direction. At this point is found an elongated oval, clear, vesicular-looking gap opening outwards, viz., the excretory pore. A short distance behind the pore is noticed the excretory cell (Ez.) lying in the middle line of the body and about half the width of the worm. It is of an elongated oval shape and possesses a lightly staining cytoplasm with a dark blue oval nucleus lying in its middle. The cell is surrounded with a small dark blue area which is connected with the pore by a thin stripe.

Genital organ.—The second distinctly stained place is the genital or anal pore according to RODENWALDT, but LOOSS, FÜLLEBORN, and SAISAWAS doubt the correctness of this statement. Like the excretory pore the genital pore here appears as a gap of variable size and form opening outwards. At a distance of several worm breadths towards the head lies a large cell, the principal genital cell (G_1) and at some distance between this and the genital pore lie closely together three smaller cells (G_2, G_3, G_4) applied closely to the side of the wall opposite the pore. All these cells are surrounded by a darkly stained area.

Besides the cells of the excretory and genital pores may be seen in deeply stained specimens a few very lightly staining spindle-shaped cells distributed along the whole wall of the body, but especially near the excretory pore. According to RODENWALDT these are known as the matrix cells of the sub-cuticula.

In many cases two indistinct red specks (M) can be seen near the buccal end of the parasite when stained by FÜLLEBORN's method. These must be analogous to the red mouth structures described in some species of microfilariae.

Internal body.—Between the excretory and genital organs is sometimes seen an elongated structure about 50 microns long with a wavy outline and a little narrower than the body of the microfilaria.

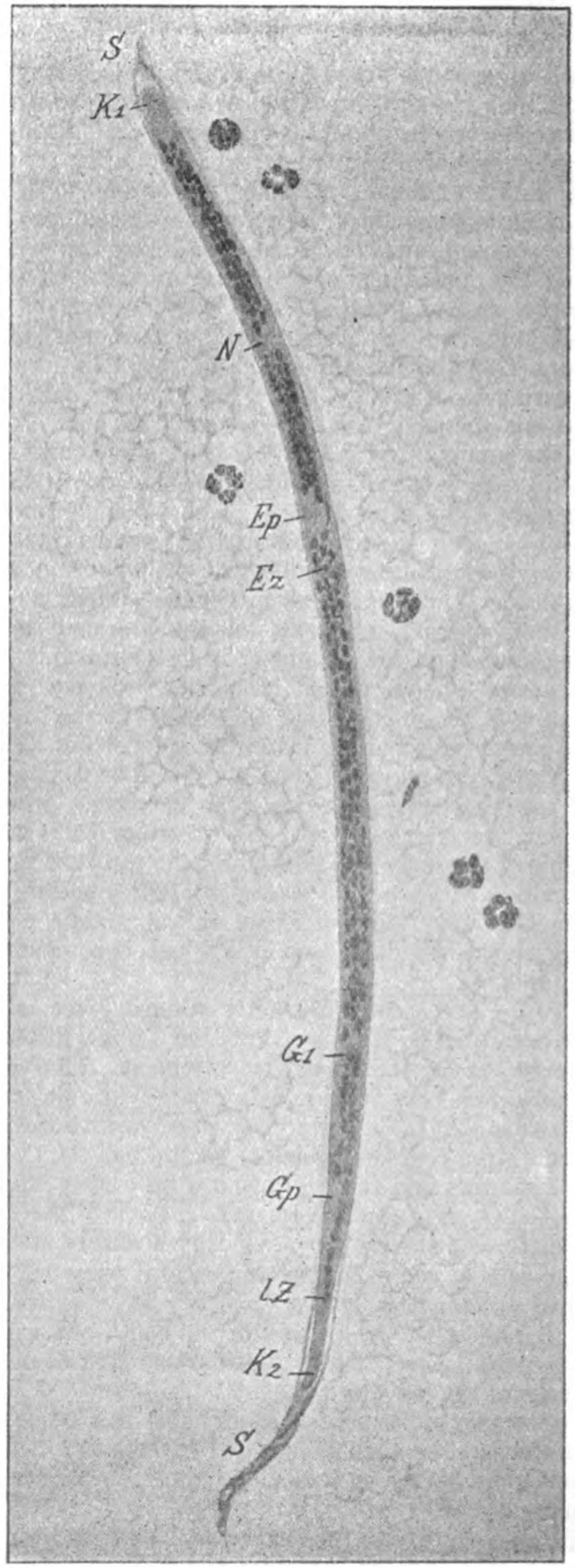

Fig. 3.—Microfilaria stained according to Looss's method. Very highly magnified. S = sheath (folded); K_1 = anterior extremity; K_2 = posterior extremity; N = nerve ring; Ep = excretory pore; Ez = excretory cell; G_1 = principal genital cell; Gp = genital pore; lZ = terminal stainable cell.

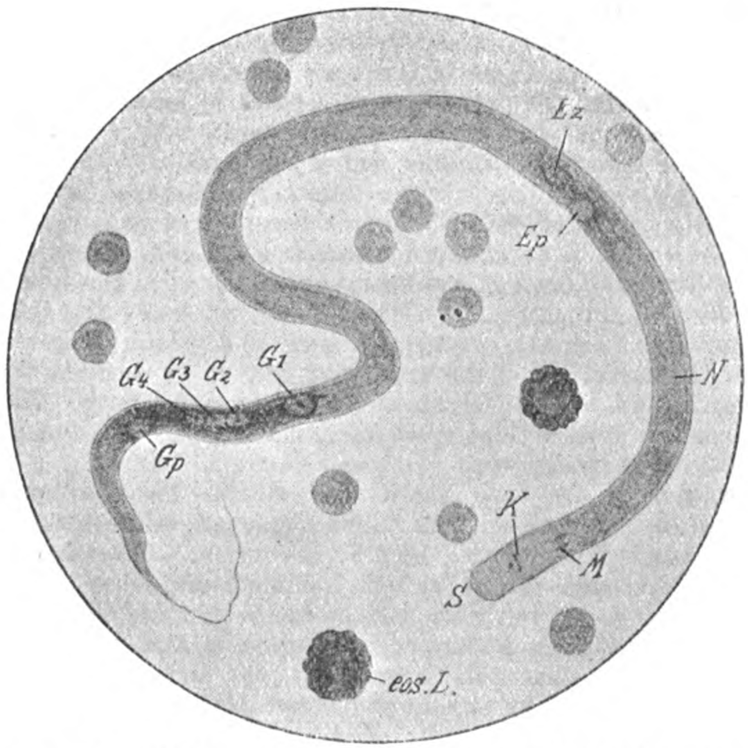

Fig. 4.=Microfilaria stained according to Fülleborn's azur-eosin method. Highly magnified. S=sheath; K=characteristic head structures; M=red mouth structures; N=nerve ring. Ep and Ez =excretory pore and cell; G_1=principal genital cell; G_2, G_3, G_4= genital cells; Gp=genital pore; eos. L=eosinophile leucocyte.

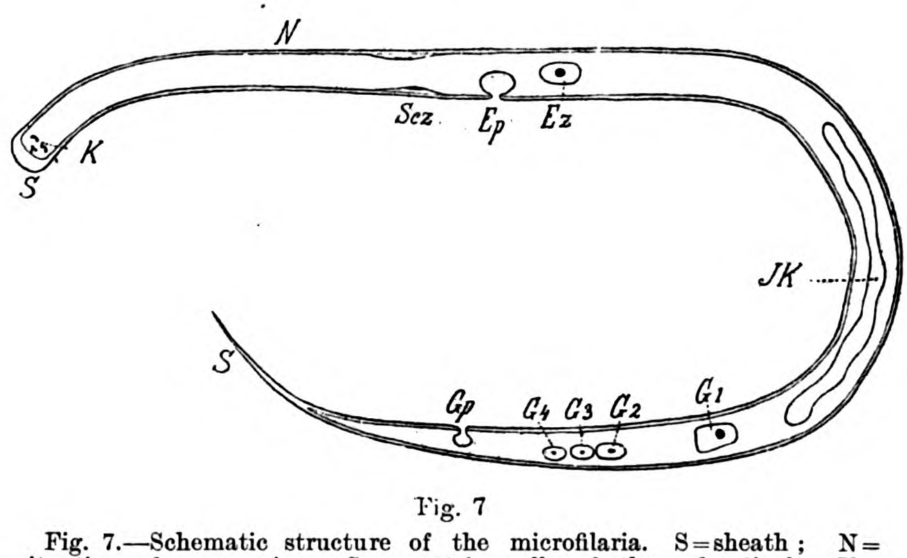

Fig. 7

Fig. 7.—Schematic structure of the microfilaria. S=sheath; N= situation of nerve ring; Scz=matrix cells of the subcuticula; K= characteristic head structures; Ep and Ez=excretory pore and cell; JK=internal body; G_1=principal genital cell; G_2, G_3, G_4=genital cells; Gp = genital pore.

It is rendered visible owing to its being less transparent than the body of the worm but its form and position are found to be continually changing. The significance of this body is not known. A short tube which is probably the gullet may sometimes be recognised.

Buccal structure.—In a fresh preparation under a high magnification one may observe at the anterior end of the parasite to the right and left of the middle line a clear refractile rod-shaped speck each apparently connected with the other. Below these two small specks may be seen still more minute but similar-looking structures. In the case of dead specimens in a preparation examined in the fresh state or stained by FÜLLEBORN'S method a few will show the following structure :—The sheath overlaps the head to a greater or less extent and at the buccal end of the worm may be seen to the right and left two small dumb-bell shaped structures running transversely. Between these may be seen a third speck of similar shape. The function of these bodies is not known.

Retraction of the body within the sheath.—This phenomenon, described by various authors in the case of other microfilariae (e.g., *M. bancrofti*), was rarely seen by the author. Close observation of living specimens under a high magnification showed that the phenomenon was in reality an artefact due to a lateral observation of the extremity during a turning movement of the parasite. The author considers that this is probably the explanation of such appearance described by authors in the case of microfilariae especially of the human subject.

Differential characteristics. — Various characters used for the recognition of microfilariae have already been dealt with, viz., (1) the presence or absence of a sheath, (2) length and breadth, (3) the characteristic position in air dried preparations freed from haemoglobin, and (4) the structure of the excretory and genital organs. The fifth important point, viz., the position of the separate fixed points of the parasite relative to its length, remains to be dealt with. These positions are stated to be constant in any given species of microfilaria but they vary in different species. Tables are given showing the percentage length distribution of the fixed points and the differences between them according to the total length of the parasite, and according to the length of the column of granules in the body. The following table represents the percentage lengths from the anterior end occupied by these fixed points in the parasite of the horse, compared with those of the two common microfilariae of the dog; the lengths do not include the sheath :—

	Nerve ring.	Excretory pore.	Excretory cell.	Principal genital cell.	Genital pore.	The terminal stained body cell.
Microfilaria immitis .	22·5%	31·0%	36·8%	64·4%	77·8%	91·8%
Microfilaria repens .	20·1%	29·2%	?	63·0%	75·9%	89·9%
Microfilaria of the horse	20·4%	31·3%	34·5%	70·4%	82·5%	91·7%

Number and distribution of the microfilariae in the blood.—As mentioned above the number of parasites in the blood of affected horses is very variable. In one case it was found that the presence of 15 microfilariae could be determined in 0·1 c.c. of blood no matter where the blood was taken from. In another case where a greater number of accurate estimations was made it was found that the parasites were not equally distributed in the circulating blood if small quantities of blood are taken. If taken at quite short intervals from the same place the number of parasites in a given quantity was found to exhibit great differences. These results were obtained whether the blood was taken from the facial vein or from the jugular. The results were the same in the case of capillary blood (taken from the lip) except that here the number was as a rule smaller. The largest number of specimens counted in the blood from the facial vein was 26 and from the lip 4 per 0·1 c.c. Considerable muscular activity on the part of the animal (galloping for ¾ hour) had no influence on the number and distribution.

Periodicity of the microfilariae.—A peculiarity of certain species of microfilariae is that they appear, with a certain degree of regularity, only at certain periods of the day in the circulating blood (e.g., *Filaria loa*, which is present in large numbers in the human blood during the day, and *Filaria bancrofti*, which is present in large numbers during the night). According to LINGARD the embryos of *Filaria sanguinis equi* are found in greater numbers in the blood during the evening and such is also the case with the microfilariae described in the camel (PRICOLO). PENEL and LOOSS state that this periodicity is probably accounted for by the fact that the parasites or their sheaths are held by some product of the host's body in the lungs at certain times and then released into the general circulation. As the human microfilariae exhibiting this phenomenon are those which possess sheaths the author carried out experiments in order to determine whether the same applied to the equine organisms. The number of parasites was thus counted during a number of days at intervals of three hours throughout the day in each case; blood was taken from the facial vein and from the lip. As the number of organisms in the blood may be very variable when samples of blood are taken at the same time from the same place the periodicity counting could only be of value if similar results were repeatedly obtained. However, as the result of these determinations it could not be stated that there was any evidence as to the existence of periodicity, although at 6 a.m. the largest (total 61) and at 6 p.m. the smallest (total 22) in seven countings was found.

Seasonal maximum.—In the author's experience the microfilariae were found most plentifully during the hotter part of the year. According to BAHNMÜLLER's experiments the parasites were found in 24 horses in summer whereas they could only be found in two horses during the following February.

Distribution in the organs.—From the results of tests on man and dogs microfilariae are present in far larger numbers in the capillaries of the internal organs, especially of the lungs, than in the peripheral blood. In the case of the parasite dealt with by the author it was found that far more specimens could be obtained after death of the horse from the spleen than from the peripheral vessels or other organs. Blood on one occasion extracted from the lungs during life did not show an unusually large number of parasites. The number found in peripheral capillary blood (lip blood) was always smaller than in the larger peripheral blood vessels.

Histological changes in filariasis.—The tissue surrounding the parasites shows no changes. In sections from various organs a few single specimens can be found in the capillaries and their presence can only be revealed under a high magnification.

Resistance of the microfilariae.—Numerous tests have shown that various microfilariae are endowed with considerable vitality. According to the author's experiments the parasites show great activity in blood outside the body but their movements gradually diminish. In fresh cover-glass preparations they remained alive for 24 hours and in defibrinated blood they were still motile after 48 hours when the blood was kept in a test tube at room temperature or in the refrigerator. In the incubator at body temperature they did not live so long. The parasites in defibrinated blood pass easily through ordinary filter paper. When dried in a thin layer on a slide they die in two minutes; desiccation seems to be most effective in killing the parasites. Addition of distilled water to a preparation on a slide brings about a gradual dying off; their movements at first are very active but after five minutes they become somewhat slower and in about 30 minutes they cease completely. In artificial gastric juice (0·1% HCl) and pancreatic juice they die off very quickly. Addition of neosalvarsan solutions (1 to 1,000 up to 1 to 100) produces the same effect on the organisms as distilled water. Their viability in the circulating blood is not known but is probably rather long (some weeks or months).

The adult stage of the microfilaria.—This microfilaria has been regarded for some time as the embryonic stage of *Filaria papillosa*; no conclusive evidence in support of this opinion has however been produced. The problem was elucidated by the author by post-mortem examination of the affected horse described above. In the peritoneal cavity were found 10 specimens of *Filaria papillosa*, viz., seven females and three males. These were all lying on the small intestine and diaphragm. All the other organs especially the large blood vessels, skin, and connective tissue were searched for filariae without result. All the organs presented a normal appearance with the exception of the spleen; this organ was distinctly enlarged, the edges were blunt and the pulp was rather firmer than normal and of a dark red colour. More microfilariae were found in the spleen than in the other organs. There were fibrinous adhesions between the spleen, liver and diaphragm.

Some of these adult filariae were placed at once in normal saline solution or in horse serum and others were fixed in hot 70 per cent. alcohol for a few minutes and then kept in this solution. Microfilaria preparations were made in the following way: about 1 to 2 cm. of the caudal extremity of the female filaria was cut off and the contents of its body squeezed out on to a slide. The preparation was then examined in the fresh state after the addition of 2 per cent. acetic acid. It was then seen that the embryos from *Filaria papillosa* possessed a sheath and that the relative measurements and buccal structure corresponded with those seen in fresh preparations of the microfilariae from the blood. The length of the organisms freshly obtained from the adult parasites or kept in serum was about 240 to 300 microns by from 6 to 7 microns broad. Those obtained from adults preserved in alcohol were found to have shrunk to about 225 to 265 microns long by 5·8 to 6·9 microns broad. The embryos obtained from the adult worms were stained after wet fixation in hot alcohol as above according to FÜLLEBORN'S azur II method without drying. Staining presented considerable difficulty. The excess of stain was sucked off by means of filter paper. The examination was begun at once but the desired depth of staining was only obtained after some time. After employing this method single specimens of the embryos were seen to exhibit the same characteristics as those of the blood parasites, especially with regard to the distribution of the cells in the genital organs and the percentage location of the fixed points along the length.

The cause of filariasis in the horse would thus be *Filaria papillosa* and the microfilaria present in the blood is *M. papillosa.*

Considering the frequent occurrence of *Filaria papillosa* in Hungarian horses (according to FIEBIGER about 30 per cent. of all horses harbour these worms) it seems strange that the microfilariae were not discovered much earlier and much more commonly. This can be explained by the fact that a systematic blood examination in cases of filariasis was not often performed and that the number of microfilariae is either very small or they may have disappeared from the blood. That the microfilariae are not so rare as is supposed was found in the examination of the military stud above referred to, although only a few preparations were taken from each horse; and, lastly, it must be remembered that microfilariae only occurred in the blood when sexually mature females and male elements are present in the body. The author mentions an outbreak of microfilariasis occurring in the summer of 1915 at Koniggratz; one horse died of pyaemia and *F. papillosa* was found in its peritoneal cavity. The simultaneous discovery of microfilariae in the blood and *Filaria papillosa* in the abdominal cavity can be traced back as far as 1848 (WEDL) in Vienna. SONSINO (1876) in Egypt made a similar discovery. DEUPSER (1892) reported that the embryos of *F. papillosa* only remained alive for a few hours in water or salt solution while in the blood they lived for 36 hours, showing that the blood is their natural habitat. The same author placed a pregnant female *Filaria papillosa* in the peritoneal cavity of a rabbit and 14 days later microfilariae were discovered in the blood. The same experiment was repeated by the author, however, without result. Lately YAKIMOFF and his fellow workers (1914–1915) have reported microfilariae in the blood of several horses in Turkestan and consider them to be most likely the embryos of *F. papillosa.*

Development of Microfilaria papillosa.—No experiments in this connection have been made but there is no reason to think that it is different from that of *F. immitis* of the dog and *F. loa* and *F. bancrofti* of human beings. As the result of FÜLLEBORN'S* experiments it was

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* [Wirth does not seem to have rendered a correct historical appreciation of the researches on the subject of filariasis. In this connection we reproduce a paragraph from an article recently written by Sir Patrick MANSON on "Tropical Medicine and Hygiene" (*Brit. Med. Jl.*, 1917. July 28. No. 2952. p. 107):—

"In 1872 Timothy Lewis, in India, ascertained that the larval filaria discovered by Demarquay and Wucherer in pathological fluids was found that mosquitoes and other biting flies ingested the microfilariae by sucking blood from an infected animal; after wandering through the body of the intermediate host the parasites are set free from the proboscis and then possess the power of boring through sound skin and entering into the internal organs. Here the parasite reaches sexual maturity and produces a large number of microfilariae which find their way into the blood stream. The intermediate host in Hungary is not known. Direct injections of microfilariae into the blood have hitherto failed to infect. A comparison is drawn between filariasis in man and in horses. In the former case the symptoms and lesions are more especially of a local nature (lymphangitis, etc.) whereas in the horse general symptoms are produced (dullness, sudden collapse, etc.). In the case of man the lesions are set up mostly by the adult worms or their products whereas in the horse it would appear that the symptoms are set up by the microfilariae. From a study of the literature it appears possible that other species of filariae may cause the appearance of microfilariae in the blood. It is only from MANDEL's description (1911) that one can ascertain that *Microfilaria papillosa* was probably being dealt with, whilst other authors might have described other unidentified species of microfilariae.

VAN SACEGHEM (R.). **Contribution à l'étude de la dermite granuleuse des Equidés.** [Granular Dermatitis of Equines.]—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 726–729.

In this paper the author summarises some observations he has made on the above disease as it occurs in equines at Zambi, Lower Congo. A brief reference is made to the literature incriminating a nematode worm as the cause of the disease.

RIVOLTA (1868) described the occurrence in the lesions of a filarial worm which he named *Dermatofilaria irritans*, a name afterwards changed by RAILLIET into *Filaria irritans*. Recently RAILLIET has pointed out the great morphological similarity existing between the parasites found in summer sores of the horse and the larvae of Spiroptera [see this *Bulletin*, 1916, Vol. 4, No. 3, p. 102]. One of the characteristics of this larva is the blunt posterior extremity

normally a parasite of the circulation. He called it *Filaria sanguinis hominis*. In 1876 Bancroft, in Australia, discovered the parental worm, *Filaria bancrofti*. Subsequently, in 1878, the writer ascertained that a Culex mosquito served as its intermediary host, abstracting the microfilaria from the blood and providing it with an opportunity for undergoing important developmental changes, during which it increases in size from a microscopic object to one just visible to the naked eye, and possessing an alimentary canal as well as remarkable powers of locomotion. In 1900 Low, at the London School of Tropical Medicine, and subsequently James in India, made the important discovery that at this stage of development the larval worm passes into the labium of the mosquito's proboscis, and gets back into man direct, the old idea of the mosquito dying on the water and the embryos escaping into this medium and so reaching man, being thereby, if not absolutely disproved, rendered improbable. Noè, Grassi, and Fülleborn in the case of the allied parasite (*Filaria immitis*) of the dog, and Bahr in the case of the human parasite, have shown the exact mechanism of how this takes place. Finally, the metamorphosed embryos arrive at the lymphatics, where development is completed and the new generation of embryo filariae born."—ED.]

studded with bristles; RIVOLTA's Dermatofilaria possesses the same peculiarity and one is thus led to conclude that the nematode of summer sores is in fact a Spiroptera larva.

Three species of Spiroptera infesting equines are known, viz., *Habronema megastoma* Rud., *H. microstoma* Schneider, and *H. muscae* Carter. *H. megastoma* can be found in the adenomatous looking tumours in the stomach of the horse and ass while the other two species live within the stomachs of equines. The evolution of the larvae of *H. megastoma* and *H. microstoma* is not known but RANSOM has worked out the various stages in the development of *H. muscae*. The embryos of this worm, which lives in the adult stage in the stomach of the horse, are evacuated with the faeces and penetrate within the larvae of flies which live on the manure. In these larvae of flies the pupae and the adult worms are evolved. These finally regain access to the stomach of the horse, probably, according to RAILLIET, when the flies alight on the moist lips of this animal or even more probably when they are ingested.

According to Van Saceghem's observations granular dermatitis occurs only in animals kept in stables; in these stables the bedding was changed and the dung removed regularly. The disease is never localised in the hind quarters but always in the fore quarters, on the legs, and at the inner canthus of the eye; lesions in other situations are rare. Equines which are allowed to live at liberty never present the disease; they usually pass the night in a place where the dung is never removed, but in the morning they leave in order to graze freely in the jungle. These facts would tend to show that the infection is not transmitted directly by means of the faeces and that flies should be held to convey the disease. If the parasite was derived directly from the dung the horses remaining all night on heaps of manure would be the ones more especially affected, and also the hind quarters would be more susceptible to infection. On the other hand, the common house flies and Stomoxys are common in the stables whereas they are rare in the jungle. The reason for the absence of infection of the hind quarters would be explained by the fact that flies are beaten away from this region by means of the undocked tail of the animal.

In a stable where several horses were affected with summer sores the author found that 20 per cent. of the common house flies were infested with a nematode larva 2·5 mm. long by 65μ broad. This larva possessed an elongated, pointed, anterior extremity and a blunt posterior end studded with bristles. The mouth communicated with a passage followed by the oesophagus, the two latter portions measuring together ·85 mm. From 3 to 5 specimens of this larva could sometimes be found in the proboscis of the fly. In normal saline solution under the microscope these larvae show very active forcible movements and penetrate within obstacles.

The above larvae found in the fly were found to differ from those found in summer sores inasmuch as the former were 65μ broad and showed no longitudinal striation whereas the latter were 50μ broad and showed marked longitudinal striation. Larvae taken from a fly and placed on the skin of a guinea-pig moistened with normal saline showed very active translatory movements but no tendency to penetrate the skin. When the moisture had been sucked up with blotting paper the larvae remained stationary and died. These experiments were, however, made during a time of the year when all summer sores show a natural tendency to healing. It is believed that the larva found in the domestic fly at Zambi is the larva of *H. muscae.* No specimens of *H. megastoma* were found in a few post-mortem examinations recently made at Zambi.

Summer sores usually reveal a large number of calcified parasites and a few living ones. There is thus a massive infection at a single point. It is not very probable that these larvae are all conveyed during one short period of time to this same point. It is more probable that certain sites show a predisposition, such as occurs on wounds with a moist surface. In the case of the inner canthus of the eye this predisposition always exists whereas in the case of the limbs there must be a pre-existing wound. If an infected fly alights on the wound the larvae penetrate and set up a pruritus similar to that described by Looss (1898) in the case of the larvae of *Ancylostoma duodenale* during their passage through the human skin. This irritation will cause the animals to bite the infected place and the large sore thus produced would further attract flies and set up a most suitable point of entry for the parasites. The author often observed that on the part of the body where a summer sore was subsequently set up an intense pruritus was manifested before the appearance of visible lesions. Further experiments on this subject are in progress.

DICKINSON (Campbell G.) & HILL (Gerald F.). **Investigations into the Cause of Worm Nodules (*Onchocerca gibsoni*) in Cattle.**—Commonwealth of Australia. Published under the authority of the Minister for Trade and Customs. 7 pp. Melbourne: Albert J. Mullett. Government Printer.

In this short paper Dickinson and Hill briefly describe a small series of experiments conducted by them at Darwin in the Northern Territory of Australia. These were commenced by MCEACHRAN and Hill in 1914 for the purpose of determining the nature of the intermediate hosts of *Onchocerca gibsoni*. In these preliminary experiments it was shown that calves placed in screened and open pens thirty yards from infected cattle did not become infected whilst in the case of calves, both Victorian and locally bred, grazing with an infected dairy herd definite nodules were discoverable on post-mortem examination, indicating that infection had taken place. These experiments were conducted during the period January to July and August, and it was decided to carry out further experiments on the same lines, but during the period July or August to January or February.

Six female calves 6 months old were imported from Victoria and on arrival at the laboratory were divided into three lots of two calves each. The first lot was placed in a screened pen enclosed with fine brass wire gauze and entrance to it was through a porch with double doors. The pen was cleansed and whitewashed and the concrete floors repaired before being used. A second lot was placed in an open pen; the third lot was allowed to run free in a paddock with three infected local cows. A three months old control calf, locally bred, was also placed in the paddock with the cows. Throughout these experiments the calves kept in both pens were fed on fodder imported from Victoria and no locally grown material was used as bedding. The other calves running in the paddock with infected cattle had their grass feed supplemented by locally grown rice chaff and the only drinking water used by them was obtained from a bored well 116 feet deep. The paddock was situated on high ground so as to prevent the calves coming in contact with swampy land; it was tick infested and the calves had to be treated periodically in order to destroy the ticks. During February, seven months after their arrival, a series of early morning observations of the calves were made with the object of discovering a possible ground-living vector that might bite the calf whilst lying down but drop off as soon as the calf rose from the ground. Searches were also made of the patches of ground on which the calves had lain but on no occasion was any possible parasite found.

In March 1916, that is, about eight months after arrival into the Territory the imported calves running out at pasture were slaughtered and in one case two small nodules about the size of a pea were found on the brisket and in the other case one small nodule about the size of a split-pea on the right side of the chest. The control calf, killed two months later, also showed one nodule about $\frac{3}{4}$ by $\frac{1}{2}$ inch on the right side of the chest. This experiment thus confirms the finding of McEachran and Hill that calves reared in the vicinity of the experimental pen and allowed to graze with infected cattle become themselves infected, as also do imported calves from a nodule-free State living under the same conditions. Further, as these calves were confined to a high well-drained paddock up to within a week of slaughter the infection could not be carried by a purely aquatic animal, it being very improbable that these could be found in the deep well water.

In the case of the two calves placed in the open pen in July 1915 the infected cattle grazing in the paddock were allowed to come up to 30 yards of the pen. From the latter part of November till the date of slaughter these calves were exposed to the attack of biting flies and were frequently bitten by *Tabanus mastersi* Walk., *Tabanus nigritarsis* Taylor, *Stomoxys calcitrans* Linn., and *Lyperosia exigua* de Meij. Flies of the last-named species were very troublesome to these calves in February and March, causing characteristic sores on the brisket, under the throat, and at the inner canthi of the eyes. It is almost certain that they were bitten also by several species of Culicidae and probably by sand flies. Buffalo lice (*Haematopinus tuberculatus* Burn) which were found on calves occupying this pen during the former series of experiments could not be found during the period July 1915 to April 1916. On the other hand ticks, *Boophilus australis* Fuller, which were not found on any of the calves used by McEachran and Hill, were rather numerous on both calves throughout the period of these experiments necessitating the use of dipping fluid on several occasions. These calves were slaughtered about eight months after arrival and on post-mortem examination negative results were obtained in both cases. The authors note, however, that certain species of Tabanidae, notably *Tabanus rufinotatus* Bigot, and *Tabanus cinerescens* Maclay, rarely, if ever, attack stock under a roof.

The two calves placed in the screened pen and kept free from the attacks of biting insects and ticks throughout the course of the experiment were slaughtered also about eight months after arrival, and on post-mortem examination negative results were obtained.

The authors thus summarise their experiments :—

"(1) Calves from a nodule-free State become infected within 8 months of their arrival in the laboratory when grazing on high ground along with infected cattle.

"(2) Calves from a nodule-free State did not become infected during the same period when enclosed in an open pen with concrete floor within 30 yards of a paddock within which affected cattle were depastured although exposed to the attacks of winged and apterous *Arthropoda*.

"(3) In view of the post-mortem findings in experiment No. 2 (open pen) negative results were to be expected in experiment No. 3 (screened pen) in which calves were protected from the attacks of the same *Arthropoda* by fly-proof netting."

The authors, moreover, consider that although the experiments did not lead to the discovery of an intermediate host of the parasite causing onchocerciasis in cattle they definitely excluded the species of flies and tick mentioned above, and also any purely aquatic forms other than those possibly found in the bore water.

A list of the blood-sucking Arthropoda which have been recorded in the vicinity of the experimental laboratory at Fannie Bay is appended.

During the period April to June 1916 six aged and two young wild swamp buffaloes which were shot in the vicinity of Darwin were examined for worm nodules with negative results. Wild zebu cattle and domestic cattle grazing on the same country are invariably infected, the former apparently more heavily than the latter. From one heavily infected zebu bull a well-developed and typical nodule was removed from the tissues under the skin 8 inches behind the junction of the last sternal rib with the sternum and 12 inches from the median line of the belly. In none of their examinations of zebu and domestic cattle were the authors able to discover *O. gibsoni* behind the femoro-tibial joint.

CONREUR (Charles) & URBAIN (Gaston). **Enterite hemorrhagica dos cães novos—Uncinariose intestinal.** [Haemorrhagic Enteritis of Young Dogs, due to Uncinariasis.]—*Arch. Brasileiros de Med.* 1916. Oct. Vol. 6. No. 10. pp. 560–563.

The authors describe a disease of puppies, due to the presence in the intestine of *Uncinaria stenocephala*, which is very prevalent in Rio de Janeiro, and forms a serious hindrance to the breeding of sporting and other pure-bred dogs. Older dogs appear to be immune, but to puppies of an age between two and six months the disease is very fatal. The symptoms begin with abdominal tenderness and bloody diarrhoea, the nature of the excreta showing that the blood comes from the small intestine. There are also symptoms of gastritis, indicated by thirst, nausea and vomiting, the vomit consisting of alimentary substances mixed with mucus and blood. The temperature rises to 40°–41° C. The pallor of the mucous membranes indicates rapid anaemia. Epileptiform attacks sometimes follow, and the animal usually dies in three or four days. Post-mortem, marked anaemia is to be observed of all the organs, while the stomach is empty and the mucous membrane of the small intestine shows haemorrhagic infiltration. Microscopic examination of its contents reveals the presence of numerous small nematodes, generally associated with tapeworms and ascarides, and ova. The worm is from 6 to 10 millimetres in length.

The disease is not to be confounded with the pernicious anaemia caused by *Ancylostoma tubaeforme* which occurs in older dogs, or with the epizootic gastro-enteritis of Stuttgart. Treatment with vermifuges has very little beneficial effect owing to the acuteness of the symptoms.*

FERRARO (Giuseppe). **I Ditteri ematofaghi della Colonia Eritrea incriminati della trasmissione delle tripanosomiasi locali.** [The Blood-Sucking Diptera of Eritrea incriminated with the Transmission of Local Trypanosomiases.]—*Clinica Vet.* 1917. Sept. 15–30. Vol. 40. Nos. 17–18. pp. 487–493.

Since the discovery of trypanosomiasis in dromedaries in the above-named Italian colony by PRICOLO (1912) the author set to work to study the nature, distribution, and mode of transmission of this disease. He found that a number of flies indicated by the natives as transmitting agents proved to be non-biting harmless species. The following list of diptera, identified by BEZZI, is given of the flies which can be safely incriminated as disease carriers :—

Muscidae : *Stomoxys taeniata* Bigot, *S. sitiens* Rondani.

Tabanidae : *Pangonia beckeri* Bezzi, *Tabanus obbliquemaculatus* Macquart (= *leucostomus* Loew, or *ruficipes* Bigot.), *T. pallidi acies*, Surcouf, *T. gratus* Loew, *T. cordieri* Surcouf, *Pangonia magretti*, Bezzi, *Haematopota abyssinica* Surcouf.

All the above are tropical species and to them must be added *Tabanus sufis* Jeannicke, which has apparently been found also in Morocco, and *Hippobosca maculata*, which is found throughout Southern Asia and in Upper Egypt. The two Pangonia species mentioned are only found in Abyssinia and neighbouring regions. *T. obbliquemaculatus* appears to be the most widespread species in the colony; it is also known in a large part of tropical and sub-tropical East Africa. No Glossina was discoverable.

According to PRICOLO's observations the trypanosomiasis observed in camels in Tripoli in 1912 was not an indigenous disease inasmuch as it occurred only in imported camels and did not spread to other camels or other species of animals. This may depend on the fact that the above-mentioned tropical blood-sucking flies do not extend further north than latitude 20° N.

The above-mentioned species are also blamed for the transmission of bovine trypanosomiasis. The camel disease, however, appears to have a much more widespread distribution than that of bovines inasmuch as the former is indistinguishable from other African trypanosomiases known as *mbori* and *el debab* and also from surra, whereas the latter is a more localised disease probably spread by the local species such as Haematopota. The native names of certain biting flies are given.

The author then describes at some length the relationship between the humidity of the atmosphere, depending on the seasons and the altitude of the districts, and the frequency of blood-sucking flies; the season during which most rainfall occurs varies considerably in Eritrea according to the altitude of the districts. Experience shows that great losses have been caused among camels especially during military campaigns when they are taken into the humid belts.

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

BACTERIAL DISEASES.

HARDENBERGH (J. B.) & BOERNER, Jr. (Fred). **Hemorrhagic Septicemia in Mules.**—*Jl. Amer. Vet. Med. Assoc.* 1917. Sept. Vol. 51. (New Series Vol. 4). No. 6. pp. 817–822.

Organisms of the fowl cholera type have been incriminated with the causation of equine affections by a number of authors. It is recalled that LIGNIÈRES (1897) and others discovered organisms belonging to this group in the blood and exudates from cases of equine influenza, but more recent work indicates that this disease is most probably due to a filterable virus. WEBB (1907) in India described an outbreak of haemorrhagic septicaemia in young mules similar to the one described by the authors; microscopical examination of the blood revealed a rich culture of bipolar organisms but as the examination was not made until about eight hours after death he did not feel justified in concluding that these organisms were the primary cause of the disease. Two years later the same author also reported outbreaks among young horses and donkeys due to a similar organism and characterised by an acute and fatal pneumonia. GILLETTE (1912), also in India, described the case of a horse which showed symptoms and post-mortem lesions of haemorrhagic septicaemia; smears from the heart blood showed a small number of organisms of the above type while those from the intestinal exudate showed them in large numbers and apparently in pure culture.

In August 1916 Hardenbergh and Boerner investigated an outbreak of haemorrhagic septicaemia in young mules in Pennsylvania. Five yearling mules were reported to have died suddenly in the affected centre within 24 hours after showing the first symptoms. Post-mortem examination of two of these cases revealed marked icterus, a sero-gelatinous infiltration of the subcutaneous connective tissue, lymphatic glands haemorrhagic and oedematous, congestion of the lungs, petechiae on the serous and mucous membranes, and slight enlargement of the spleen. The diagnosis was thus based on the fact that the lesions were identical with those observed in the acute form of the disease in cattle, without the presence of pneumonia or any other condition to indicate that the lesions were of a secondary nature. The heart blood and tissue fluids were found to contain large numbers of typical bi-polar staining organisms of the fowl cholera type uniformly distributed and in pure culture. These were readily isolated on culture media and showed the growth characteristic of this group. Inoculation of cultures into rabbits and guinea-pigs gave negative results. Similar results had previously been obtained by Boerner in working with strains of bi-polar organisms isolated from a virulent outbreak of influenza.

The other animals kept in the same stable, including three horses over 12 years old and one mule over five years old, appeared perfectly normal at the time of the outbreak. The authors were unable to determine the source of the infection. The animals were stable fed and their food consisted of hay and oats of rather a poor quality. Cultural and animal inoculation tests with feeding and drinking material gave negative results, but as it had been found that the organism was avirulent for the small laboratory animals these tests did not necessarily eliminate these materials as sources of infection.

WATSON (E. A.). **Report on Ulcerative Cellulitis—Ulcerous Lymphangitis.** *Vet. Jl.* 1917. Nov. Vol. 73. No. 11. pp. 382–396.

This report, issued by the officer in charge of a Bacteriological Laboratory of the Army Veterinary Corps in France, deals with a condition termed "ulcerative cellulitis" by the British Army Veterinary Service. The author claims to have established "on the clearest bacteriological evidence" that this disease is identical with that better known as ulcerous lymphangitis (*la lymphangite ulcereuse* of NOCARD).

It appears that these names are often believed to designate separate morbid entities, this misconception arising owing to a lack of knowledge concerning the symptoms and lesions set up by "varieties" of the Preisz-Nocard bacillus.

In the Army Veterinary Service "ulcerative cellulitis" is held by certain observers to be different from "ulcerous lymphangitis" inasmuch as the lymphatic glands are not involved in the former condition; Watson shows that this idea is erroneous as the standard descriptions of "ulcerous lymphangitis" clearly point out that no distinct lesions are observable in the lymphatic glands.

A systematic description is given of the causal organism together with the symptoms and lesions produced by it. This contains very little that is new. The author omits to give even a brief review of the literature written in connection with the disease under consideration and the characters displayed by the so-called "varieties" of the Preisz-Nocard bacillus.

In some passages the author fails to reveal a capacity for clear argument such as might be expected in a scientific article, for example: "Finally, it is probable that many causes [cases ?] of simple wound infections and abscesses arising from punctures of the skin—due to one or another of the varieties of pyogenic diplo-, staphylo- or streptococcus—are mistaken for 'ulcerative cellulitis.' Such infections may and do not infrequently occur in the disease under discussion, but then they are secondary and not causative factors."

The most important matter discussed deals with the so-called "vaccin therapy" of the disease. The vaccine used in this treatment is made from a surface-agar growth of several strains of the Preisz-Nocard bacillus. This growth is emulsified in salt solution and washed by centrifugation. The sediment is treated with equal parts of alcohol and ether, or pure acetone, which is then evaporated. The object of this process apparently is to obtain certain quantities by weight of the bacteria. The stock vaccine consists of 1 per cent. of these dried bacteria in a sterile glycerinised carbolised saline solution. This is steamed for 2 minutes and again diluted with an equal volume of the same diluting fluid. The author states that the doses and frequency of injection have been worked out by many trials and experiments, and the system of vaccine treatment recommended is based on the results obtained.

[It is much to be regretted that an outline of these experiments has not been published as one would have then been better able to appreciate their value.—ED.]

Vaccine treatment commenced at the onset of the disease is stated to result usually in a cure within a month.

When the specific infection is quite recent and localised one should begin with a 1 c.c. dose increasing by 0·5 c.c. for each subsequent dose at seven days' interval over a period of four weeks. When the disease is well-established, chronic, or recurrent one should begin with a dose of 2·0 c.c., increasing the dose by 0·5 c.c. in the same way until five doses have been given at weekly intervals; finally a dose of 5 c.c. is given after a further seven days.

The reactions are entirely local. Thermal and general reactions are slight or altogether absent. The vaccine method of treatment is contra-indicated in cases of marked debility. In chronic cases or where secondary infections with staphylococci and streptococci exist a dose of polyvalent vaccine may be given in the intervals between inoculation of the vaccine prepared from the Preisz-Nocard bacillus. It is essential that the horse should be well exercised during the whole course of the treatment. The local treatment of ulcers and abscesses should consist of frequent irrigation with normal saline solution.

A brief description is then given of some preliminary experiments with the vaccine method of treatment. In one series designated "vaccination after infection" two horses were inoculated under the skin of the fetlock with a virulent culture of the Preisz-Nocard bacillus, and vaccine treatment commenced on the 10th and 13th day in the case of each horse, respectively. The lesions which had been set up healed completely. No control animals were used.

In another series headed "vaccination before infection" two horses were given injections of the vaccine and then inoculated subcutaneously with virulent culture. Very small abscesses resulted which healed up rapidly. No controls were again used.

Between March and the end of July 1917 over 6,000 doses of vaccine made from the Preisz-Nocard bacillus were issued, and an approximately equal number of doses of the polyvalent mixed vaccine.

A summary of the results of the treatment is given in the case of 350 horses in a table and of this number 57·6 per cent. were discharged as "cured." It is claimed that the percentage would have been undoubtedly higher if a number of horses under treatment had not been disposed of for various other reasons. [It would have been of great help if the author had indicated what in his opinion is the average percentage of cures in untreated cases or in cases treated by other methods.]

According to the author "the officers who have carried out the above treatment after a previous experience of surgical and antiseptic methods, often the most heroic, speak unhesitatingly in favour of vaccination."

[It is, of course, common knowledge that opinions thus derived from clinical experience are liable to grave error when not accompanied by statistics giving the comparative results of treatment by other methods.

Although no previous work on the employment of this line of treatment is referred to by the author the method is not new. It was tried recently by Montgomery in British East Africa (see this *Bulletin*, Vol. 5, No. 1, p. 64) and by Truche in the case of French army horses (see this *Bulletin*, Vol. 5, No. 3, p. 187).—Ed.].

DISEASES DUE TO FILTERABLE VIRUSES.

SOHNS (J. C. F.) & SOETEDJO (Raden). **Infectieuze Anaemie der Paarden.** [Equine Infectious Anaemia.]—*Veeartsenijkundige Bladen v. Nederl.-Indië.* 1917. Vol. 29. No. 2. pp. 141–174. With 2 tables.

In August 1916 the Dutch East Indies Veterinary Laboratory was requested to investigate a sudden outbreak of disease among imported Australian horses. These horses showed disturbances in connection with the nervous and locomotor systems, especially of the hind limbs, which gradually progressed until the horses became useless and dangerous for riding. The disease was at first suspected to arise in connection with the central nervous system. The first animal examined was a 15 year old mare which was unable to lay down, often sleeping standing and falling down, and then unable to get up without assistance. At work it walked with outstretched neck and drooping head and when let loose in a field it circled to the left and had great difficulty in turning to the right. After slaughter a slight degree of hydrocephalus externus was discoverable but otherwise the central nervous system presented nothing abnormal.

The second case was a nine year old Australian mare affected at work with paresis of the right hind leg while the loins and croup were more or less hypersensitive. At times the animal could take a few normal steps with the lame leg and from time to time the lameness shifted to the left leg. Dyspnoea set in readily after slight exertion. The appetite was fairly good. No abnormality in connection with the central nervous system was again discoverable on slaughter; a rabbit injected with sub-dural fluid remained healthy.

The third case was an Australian mare bought in for a nominal sum on account of ataxic movements. The animal was in very poor condition in spite of its good appetite; the lameness was seen to affect one of the hind legs and then suddenly the affected limb became more or less sound while lameness appeared in the opposite limb. The forelegs then became so stiff that the animal was crippled in all four legs and towards the end it walked crookedly to the right or to the left. Finally, the mare was unable to get up without assistance, and after walking a few steps sweated profusely; the breathing became very rapid. The case was diagnosed as osteoporosis. On slaughter the muscles were friable and paler than normal; the kidney showed a few dark solid masses about the size of pigeons' eggs. The backbone was broken in falling; the bones of the limbs were easily sawn through. In the femora and humeri normal yellow marrow was only found in the distal epiphyses; otherwise the spongiosa contained a brownish-red substance, while the fat in the large bone cavities was of a brownish-yellow colour and semi-transparent; the interior of the fat contained dark red centres of varying size. The compact bone had become very thin while the spongy bone was enlarged pointing to a process of rarefying ostitis. Smears from the blood showed anaemic changes; the bone marrow, however, showed nothing special. Inoculation of small experimental animals and culture media gave negative results. The osteomyelitis, firm centres in the spleen, and degeneration of the skeletal muscles aroused the suspicion of infectious anaemia.

In order to confirm the diagnosis the authors injected an Australian horse with 190 c.c. of defibrinated blood from one of the above cases, while another horse received an injection of 40 c.c. of filtrate obtained by passing the defibrinated blood from another patient through a Chamberland filter. After 33 days both inoculated horses showed a rise in temperature and a few days later locomotory disturbances in the forelegs. The horse inoculated with the filtrate then suddenly showed paresis in the hind legs.

Native horses were shown to be equally susceptible; four of these animals were infected with blood from the same animals as the Australian horses were inoculated with. The symptoms were less apparent in the Java horses owing probably to the shortness of the limbs but the loss in weight was very noticeable and also the intermittent pulse.

The authors then enter into a detailed discussion of the history, distribution, etiology, probable modes of infection, pathogenesis, together with the symptomatology, morbid anatomy and diagnosis of the disease in the usually described so-called acute, sub-acute, and chronic forms. It is suggested that the name "infectious osteomyelitis" of horses would be more appropriate for the disease, which is thus defined as "an infectious disease of equines caused by a filterable virus, and which develops as an acute or more or less chronic septicaemia, and presents a clinical picture displaying most strikingly a series of ill-defined lamenesses usually connected with acute or chronic anaemia."

With regard to the mode of transmission the Japanese Commission was led to believe that this took place principally by means of flies, although experiments in this connection proved negative. According to the authors horses became infected at Buitenzorg in fly-free stables and thus infection could only have taken place through the eating of straw soiled with urine. The straw was taken out in the morning, dried and cleaned and taken back into the boxes at mid-day. Horses doing no work were addicted to eating their bedding consisting of rice straw, which is very appetising. The authors admit the possibility of infection by means of Tabanidae although natural infection in the Dutch East Indies probably occurs chiefly through eating soiled straw. The presence of the infectious material in milk is also a source of infection in foals.

In 1910 a fatal outbreak among foals showed peculiarities which pointed to the acute form of the disease. The foals presented unsteady gait, stupor, frequent pulse and loud heart beats, a yellowish discharge of saliva, loss of appetite, high temperature and frequent dyspnoea; the urine was cloudy and contained a large quantity of albumin. Post-mortem examination showed icterus, congestion and swelling of the lymphatic glands and of the spleen, haemorrhages under the renal capsule, parboiled appearance of the heart and skeletal muscles, and urine rich in albumin.

With regard to the morbid anatomy of chronic cases it was found that in most cases at Buitenzorg the bone could be easily sawn through or even cut; sometimes this applied to all the bones, sometimes only o the humeri and femora, and at other times to the ribs. THEILER attaches no importance to the bony changes as he found them in horses which had died of other diseases or were killed before death as controls. The bones of all the horses suspected of being affected with infectious anaemia by the authors were examined and the changes described above in the case of the third horse examined were found in all.

The authors claim that horses showing the following symptoms should be looked upon with suspicion, viz. (*a*) anaemia with varying colour conditions of one or other of the conjunctivae, (*b*) falling in the stable and difficulty in getting up, (*c*) from time to time a few days fever without apparent cause, (*d*) swellings of the belly, sheath, or hind limbs in the absence of surra, (*e*) diminution or absence of appetite without apparent cause, (*f*) loss of condition in spite of good feeding, (*g*) slipping a great deal in the stable, (*h*) abnormal tiredness, (*i*) stiffness of movement in the form of ataxia, or lameness without apparent cause ; the shifting of the lameness from one limb to another is very characteristic ; the best means of showing this is by lounging once or twice a day for half-an-hour, (*j*) arhythmia or rapidity of the pulse and heart beat ; this is often observed in the stable but increases at exercise, with the appearance of a venous pulse. The inoculation of susceptible horses is the only certain means of diagnosis. One has to resort in practice to other less costly, but unsatisfactory, processes.

The authors discuss the tests devised by ZSCHOKKE and by FINZI. The former, who employed the so-called " sinking " test, collected blood in vessels which were cooled down quickly and then the percentage of corpuscles was calculated from the height of the column of corpuscles. The authors added a solution of sodium citrate to the blood instead of cooling it in order to obtain the same result. The test devised by FINZI, consisting in the demonstration of autolytic substances in the serum of suspected horses, was found to give much better results. This test consists in the addition of 5 c.c. of serum to be tested to 1 c.c. of a 5 per cent. suspension of washed red blood corpuscles from a healthy horse. The appearance of haemolysis is stated to point with certainty to the existence of infectious anaemia. According to FINZI haemolysis can thus be produced on the 12th day after experimental infection and in any case after the 24th. FINZI asserts that the corpuscles sometimes become agglutinated under the influence of the affected serum forming small clumps about the size of pins' heads.

The authors were unable to discover albumin in the urine probably because they had not examined a sufficiently acute case. The regular weighing of the animal body in order to discover any loss in weight is also considered to be of importance. The disease can be differentiated from a sclerostome infestation inasmuch as no fever is observed in the latter disease.

With regard to treatment the authors tried the injection of ox gall inasmuch as the Japanese Commission found that sodium taurocholate had a very toxic effect upon the virus. This, however, produced a marked local lesion. Experiments are being performed in connection with the use of sodium citrate. The serum from recovered horses is, of course, dangerous as it still contains virus.

With regard to preventive treatment the authors recommend slaughter of all affected animals. Infected mares are dangerous and their foals are probably born infected or later imbibe the virus with the milk. Purchased horses should be carefully examined by being placed on light work for a few days coupled with a test of the serum if possible. Australian horses are held under most suspicion as the disease is believed to be imported undoubtedly from Australia. South African, Tonkin, and Japanese horses are also suspicious; Indian and Mongol ponies are recommended. The author in conclusion details a series of preventive measures applicable to this disease.

NEVERMANN (L.), MIESSNER (H.) & WEICHEL (A.). **Studienreise nach dem Balkan.** [Travel Studies in the Balkans.]—111 pp. With 80 text figs. & 2 tables. 1917. Hannover: M. & H. Schaper. [Price Mark 3.50.]

This publication consists of a description of a journey undertaken by the above three authors to Bulgaria and Turkey at the request of the German Minister of Agriculture in October 1916, with the object of studying the contagious diseases of animals of these countries and the methods there employed in dealing with them.

A considerable number of details are included respecting places of general interest in, and the economic aspects of, the countries visited from the point of view of agriculture and stock-breeding. As regards contagious diseases information was obtained on sheep pox in Bulgaria and rinderpest in Turkey. These two diseases are apparently responsible for by far the most serious epizootics among stock in these countries. A few remarks are given on equine piroplasmosis on the Macedonian front of the Bulgarian army.

The following figures represent the live stock returns for the year 1910 in Bulgaria:—horses 478,222, asses 118,488, mules 12,238, cattle 1,606,363, buffaloes 412,978, sheep 8,669,260, goats 1,464,719, and pigs 527,311. Before the year 1880 stock breeding in this country was in a very neglected state but considerable progress has been made since its independence. The control of stock-raising is at present very largely in the hands of Government veterinary surgeons; the two national studs are managed by veterinary surgeons. The cattle are principally of the Podolian breed and are used for food and draught purposes. Sheep-breeding is of the highest importance, mutton representing the chief meat food of the people while sheep-milk and cheese form a large part of the human food. Pig breeding is of minor importance probably largely on account of the fact that pig food is not grown. The poultry industry is very important.

Details are given with regard to the Bulgarian Veterinary Service, an organisation of recent origin, but which proved its efficiency in the eradication of rinderpest after its introduction into the country during the late Balkan war. There is no veterinary school in the country, students being trained abroad, principally in Germany and France. Further details are given with regard to the veterinary bacteriological institute in Sofia, which is under the direction of Dr. ANGELOFF. This consists of a well-equipped laboratory where sera and vaccines for dealing with the more important animal diseases and even some human diseases are manufactured. In connection with this institute there is a rinderpest station, situated at Burgas on the Black Sea coast, which was erected by ANGELOFF for the suppression of rinderpest in Bulgaria during the 1912–1913 Balkan war.

Equine piroplasmosis.

A short visit was paid to the Macedonian front to study equine piroplasmosis. Information was obtained that the disease occurs chiefly during the months June-August. In the summer of 1916 about 200 horses belonging to the Bulgarian-German troops were affected. The native horses of this region are only slightly or not at all affected. The symptoms commence with loss of appetite, dullness and rising temperature, followed by a yellowish discolouration of the eyelids, and petechiae on the mucous membranes of the eyes, mouth, and nostrils. Later, loss of condition and oedema set in. Piroplasms in varying numbers may then be discovered in the corpuscles. Some of the animals die, the others become chronically affected, emaciated, and die from exhaustion. On all animals were found ticks of the species *Dermacentor reticulatus.* At the time of the authors' visit no animals were suffering from the acute stage but several horses were seen which had become affected in the preceding June and had recovered; no piroplasms were discoverable in the blood of these animals. The weather during the preceding summer had been hot, rain falling on only a few days. Horses were picketed in fields; where only a small proportion of animals were slightly affected these fields were rather dry, but acute cases occurred in the wetter fields which were also covered with shrubs. Haemoglobinuria was rarely observed. In the Second Bulgarian Army during the spring and summer of 1916 out of 1,500 horses belonging to five mounted units about 200 became affected with piroplasmosis, from which about 40 died.

Sheep pox in Bulgaria.

This disease is of very great importance on account of the relatively great dependence of the country on its sheep industry. (There are about 26 times more sheep per head of human population in Bulgaria than in Germany). The danger of the importation of the disease into Germany during the present war had also to be taken into consideration owing to the very close relationship existing between that country and the Balkan States. The disease has already appeared around Breslau on account of sheep imported from Macedonia and also in those parts of Russia occupied by German troops. The ten million sheep in Bulgaria are distributed mostly in flocks of from 50 to 100 head owned by the peasants and remain at pasture the whole year. Material for study was easily obtained on account of the widespread distribution of the disease throughout the country. An account is thus given of two affected flocks kept at places lying a short distance from Sofia. In one of these places the sheep had been vaccinated and when examined about a fortnight later all appeared sound with the exception of two or three sheep, which were dull and not grazing. A brief description is given of the symptoms exhibited by these animals and a full description of the disease in a naturally affected animal on the same place. A very full account is also given of two affected animals in a second outbreak. The descriptions are accompanied by a number of photographs of the lesions. The symptoms and lesions correspond with those given by other authors and also in text books. These are, briefly, slight muco-purulent discharge from the nose and eyes, papules and pustules from the size of a lentil up to a bean on the upper and lower lips together with crusts and scars as the result of the bursting and healing of these lesions. Similar eruptions could be discovered on the woolly part of the skin; the submaxillary glands were swollen and painful; the skin on the inner surface of the fore and hind limbs, around the vulva, and under the tail likewise revealed eruptions in various stages occurring simultaneously. The papules were red and painful, and later formed cupola-shaped pustules which burst forming shallow ulcers, and these became covered afterwards with a scabby mass about the size of a shilling. No internal lesions were seen in the very few cases examined post-mortem by the authors, although pneumonia is very often observed and inflammation of the subcutaneous lymphatic glands; widespread and very numerous lesions of the skin are observed in such cases.

On account of the widespread character of sheep pox in Bulgaria vaccination is at present extensively performed although by this means new virus carriers are artificially produced. The number of sheep vaccinated yearly varies from 500,000 to 800,000. The losses caused by this operation reach from between 0·4 to 0·6 per cent. while, on the other hand, the losses caused among affected flocks left unvaccinated vary from 5 to 50 per cent. As soon as an outbreak is reported the whole of the affected flock is vaccinated free of charge, usually together with all flocks in the neighbourhood. The vaccinated sheep are placed under the same regulations as the affected animals and are held to be infective for three months, during which time the animals are strictly isolated.

The lymph is always obtained from artificially infected sheep, and not from natural cases as is more usually done, inasmuch as material free from outside contamination can be prepared in this way. The sheep employed for lymph production is shorn over the right side of the chest and abdomen. The patches to be inoculated are shaved and swabbed with 3 per cent. boric acid solution. The sheep thus prepared is secured on a table with its right side facing upwards and lymph from a previously infected animal is usually applied to twelve different places at a distance of about two fingers breadth apart. The inoculation is performed by means of a specially constructed syringe which can be regulated so as to deliver half or whole drops of fluid. The syringe is fitted with a very fine thin needle about 1 inch long which is inserted with a slight turning movement within the skin along its whole length until its point emerges from the needle tract; the needle is then pulled back to within a short distance of the point of entry and one drop is squeezed into the canal. If a trace of this drop appears at the exit of the needle path then the cutaneous application has been correctly performed. Each skin patch receives four such needle tracks of which two lie above one another so as to form a continuous line while the other two run across this path perpendicularly to its middle.

The seat of injection shows a slight swelling in from 4 to 5 days. The temperature rises on the 3rd to the 4th day after injection to from 40° to 41° C. Later a red raised hot painful papule about the size of a two shilling piece appears. Lymph is usually collected on the ninth or tenth day. The collection of material later is not recommended on account of the necrosis of the overlying skin and subsequent infection.

In order to secure the lymph the sheep is fixed as before and the skin and swelling shaved, washed, and douched with boric acid solution, mopped with cotton wool and dried with a sterile cloth. One presses an area of skin between the thumb and forefinger so as to form a fold containing the papule and clamps the base of this fold by means of two strong pairs of forceps. A horizontal incision is then made along the length of the fold and the fluid exuding from the wound is sucked up into a syringe fitted with a wide bored needle. A further quantity is obtained by deeper incision. Another incision is then made outside the first incision laterally under the skin. By placing two additional pairs of forceps within the first two one can squeeze out the fluid still remaining in the tissues after the incision and then suck it up. In order to obtain the last drop of lymph from the papule a third pair of forceps is placed between the second pair. In this way from 10 to 15 c.c. of lymph can be obtained from a papule, or 100 to 150 c.c. from the twelve papules obtained on one animal.

The lymph is then mixed with from 2 to 6 times its bulk of 3 per cent. boric acid solution, filtered through gauze, and distributed in tubes, each containing 1 c.c., which is sufficient for about 100 animals. The degree of dilution depends on the quality of the eruptions. If the animal presents marked eruptions and a typical rise of temperature together with symptoms of a severe general infection, the lymph obtained is very virulent and is most highly diluted. On the other hand if the papules are feebly developed and the sheep is only affected with slight general symptoms, the lymph is slightly diluted.

The inoculation of flocks.is performed by means of the same kind of syringe as is used for the lymph-producing animal but furnished with a very strong short needle with a lancet-shaped point. The needle attached to the syringe is inserted through the skin of the ear, a small ring situated just above the point preventing it from penetrating too deeply. The point is then turned so that the opening of the needle faces the cartilage of the ear and a half or one drop of lymph is then pressed out of the syringe. Adult animals are given 1 drop, lambs only ½ drop. These quantities are stated to be easily given by means of the mechanical arrangement fitted on to the piston of the syringe. On account of the deterioration of the lymph on keeping ANGELOFF uses only fresh or less than 2 to 3 weeks old lymph, and thus only a small stock is kept in reserve.

Rinderpest in Turkey.

The consideration of this disease as it occurrs in Turkey is preceded by a chapter in which the agriculture and veterinary service of the country is described at some length. Agriculture, although constituting almost the sole industry, appears to be in a deplorably backward condition partly owing to former misgovernment and partly owing to the fatalistic temperament of the inhabitants. The animal population at present is composed of 6,132,507 cattle, 864,000 buffaloes, 1,500,000 horses, 144,000 mules, 1,370,000 asses, 20,000,000 sheep, 17,000,000 goats, 320,000 camels, and 40,000 pigs. The improvement of stock by breeding hardly exists. In Anatolia native cattle consist of small wretched looking animals hardly more than 3½ to 4 feet high; draught oxen are composed of the greyish-white Podolian breed. Similarly the horses mostly used consist of the small but very hardy and tough Anatolian horses, which are used for draught and pack purposes and crossed with Arab blood for riding purposes. Sheep and goat breeding is very extensive as in Bulgaria but pig breeding is extremely small owing to the Moslems' religious distaste for pork.

The veterinary service of the country is of very recent origin. In 1858 a military veterinary school was opened at Constantinople under the direction of French teachers. A civil veterinary school was opened in connection with the medical faculty of the University of Constantinople in 1889 and after various changes an independent school was built in 1900. Eleven years later this institution was burnt down but owing to internal disturbances it has not yet been reconstructed. In 1910 owing to the great need for veterinary surgeons a two years course was instituted for so-called army surgeons who are appointed to assist the fully trained veterinary surgeons. Veterinary teaching in the civil school is in abeyance during the present war. The military school at Scutari is a modest building in which students undergo a four years course which, until recently, was conducted in the French language.

There are three research and serum Institutes in Asia Minor, viz., at Pendik, established in 1910, Eskeschir, established in 1913, and in Aleppo (removed from Ersingian), established in 1911. The work of these Institutes consists mainly in the manufacture of rinderpest serum. Details are given regarding the organisation of the civil and the military veterinary services.

Rinderpest is always enzootic in Turkey in Asia and has always found easy means of transportation into Turkey in Europe. Owing to the very strict police measures adopted in Bulgaria the disease has been prevented from spreading towards the remainder of Europe. For a long period during the late Balkan war, however, the eastern portion of Bulgaria became affected owing to the importation of the disease with the stock of fugitives. Considerable apprehension is expressed lest the disease should gain access to the territories of the Central Powers owing to the importation of cattle used for slaughter and transport by Turkish troops fighting in those countries. The danger is increased owing to the lack of knowledge of the veterinary surgeons of those countries regarding the primary symptoms exhibited in the scene of an outbreak.

Next follows a description of the pathological institute at Pendik situated in Asia Minor on the borders of the Sea of Marmora. This consists of well-equipped laboratories and buildings erected in 1910 at a cost of about £10,000. Accommodation is provided for about 300 serum animals.

For virus production the above-mentioned small Anatolian cattle are used. These are infected subcutaneously with from 5 to 10 c.c. of fresh defibrinated blood from a sick animal; in from three to five days a rise of temperature to 40° or 41° C. takes place and during the following two to four days distinct clinical symptoms affecting in some cases the respiratory and in others the digestive tract appear, and also symptoms affecting the conjunctiva and the buccal mucous membrane; the appetite completely disappears. Very soon the temperature drops suddenly and death occurs within the next 24 to 48 hours. In order to render suitable virus the animals should show distinct clinical symptoms besides fever and inappetence, and such a virus is obtainable as soon as diphtheritic lesions on the mucous membranes or marked diarrhoea appear. The virus animals are bled from the carotid artery into a flask containing a certain quantity of alkaline sodium citrate. The jugular vein is in the meantime connected with an apparatus for the infusion of sterile salt solution in order to obtain as much virulent blood from the artery as possible. In this way from 6 to 8 litres of blood mixed with salt solution can be obtained from a small Anatolian ox. The virus remains in the blood from 10 to 15 days, but the blood is as a rule injected immediately into the serum animals.

In order to obtain sufficiently large quantities of serum only cattle of the large Podolian breed are used for serum production. A so-called ground immunity is produced by the subcutaneous injection of 1 c.c. of virulent blood on one side of the body and 50 to 80 c.c. of anti-rinderpest serum on the other side. The inoculated animals are observed during the following days and should serious symptoms arise a further application of serum is made in order to avoid a fatal termination. If, however, the animal only reacts slightly then a further subcutaneous injection of 20 c.c. of virus is made on the 20th day and if no appreciable reaction follows a dose of from 1 to 3 litres of virus is at once injected intra-peritoneally. If on the other hand the animal reacts strongly to the first injection then a dose of from 1 to 3 litres is injected intraperitoneally on the 20th day. The serum animals are bled in the standing position and four litres of blood are withdrawn at each blood-letting. Five days later a further four litres of blood is taken, and again after another five days a similar quantity. The animals are allowed to recuperate for ten days, and then receive a fresh large dose of virus intra-peritoneally; bleeding is repeated as before, commencing after an interval of 12 days.

On account of the frequent occurrence of piroplasmosis one has to be careful to employ animals whose blood is free from piroplasms for virus production. The blood of these animals is thus examined during the whole period they are under experiment and as soon as piroplasms are detected they are treated with trypanblau. If the piroplasms disappear from the blood up to the climax of the rinderpest infection then the blood is used for the injection of the serum animals; on the other hand, if the parasites remain in the blood the animal is discarded from further use. One has thus to reckon with 30 per cent. piroplasm infection among the virus animals, whilst a further 20 per cent. of the virus animals are of no use inasmuch as they contract too mild a disease for the production of suitable virulent blood. The institute delivers about 600 litres of serum per month, uses up about 700 virus animals in the course of a year and keeps up a stock of about 150 serum animals.

The method employed in Bulgaria for the production of anti-rinderpest serum was as follows:—

While no serum was available a ground immunity was set up by the inoculation of 10 to 15 c.c. of gall subcutaneously followed 10 to 15 days later by a subcutaneous injection of from 1 to 5 c.c. of virus. Later on this immunity was set up by the injection of 10 c.c. of serum on the left and 1 c.c. of virus on the right side of the neck. The further procedure differed according as to whether the rapid or the slow method of obtaining serum was employed.

(*a*) Rapid method.—(1) As soon as the animals recovered, 1 to 3 litres of virus subcutaneously, after two weeks, (2) 1 to 7 litres of virus subcutaneously, after 12 days a first bleeding of 4 litres, after a further five days a second bleeding of 4 litres, after a further five days a third bleeding of 4 litres, after three weeks (3) 1 to 7 litres of virus subcutaneously, and later after 12 days bleeding as before.

(*b*) Slow method.—(1) Half litre virus subcutaneously, after 10–14 days, (2) 2 litres of virus subcutaneously, after 10–14 days (3) 2 litres of virus subcutaneously, and so on until 6 litres had been given.

More recently the rapid method was used for the most part. After the production of a ground immunity by the injection of 10 c.c. of serum and 1 c.c. of virus and recovery of the animal 2 to 8 litres of virus were injected subcutaneously. After 10 days the animals were bled for serum.

The authors next devote a considerable amount of space to the symptomatology and morbid anatomy of the cases observed by them during their visit. This description is accompanied by a number of quite good figures. Nothing new, however, is added to what is already known regarding these matters.

In Asia Minor rinderpest is frequently complicated with piroplasmosis. Animals thus affected pass a red-coloured urine and on post-mortem reveal marked swelling of the spleen. Piroplasms are easily discoverable on blood examination. These animals undoubtedly had been subject to a previous attack of piroplasmosis, the parasites as is well known being capable of remaining in the body for years without setting up apparent symptoms.

Outbreaks of rinderpest in Turkey are dealt with in the following way:—As soon as the disease is reported in a locality all animals showing a rise of temperature are isolated. All animals showing clinical symptoms such as lachrymation, lesions on the buccal mucous membrane, and diarrhoea are immediately slaughtered. The cattle showing no fever and which are otherwise apparently healthy are quarantined and injected with anti-rinderpest serum (ox 80, buffalo 100° c.c. subcutaneously). From the 2nd to the 9th day the temperature is taken daily and if a temperature of over 40 C. is registered on two occasions the animal is slaughtered. On the 15th day the serum injection is repeated. No further temperature readings are made. A month after the appearance of the last case of rinderpest the quarantine restrictions are raised.

BROGAN (G. H.). **Notes on Contagious Bovine Pleuro-Pneumonia in Northern Rhodesia.**—*Vet. Jl.* 1917. Oct. Vol. 73. No. 10. pp. 369–371.

This disease was introduced into Barotseland in 1915 from Portuguese West Africa where it appears to have been enzootic for several years. From there it was brought down to several cattle districts on the railway line by traders and a number of deaths from the disease seems to have occurred during transport.

The disease then spread rapidly among cattle in the areas into which it had been introduced, probably owing to the absence of a qualified veterinary staff. Energetic measures were, however, carried out as soon as possible involving quarantine of all herds in each suspected area, slaughter of all affected animals, inoculation of all in-contacts and suspected in-contacts as far as the supply of virus permitted, branding of all animals so inoculated, and finally the establishing of a " buffer " area in which no cattle movements of any kind were allowed for some time in order to cut the disease off from the remaining cattle districts. The slaughtering of affected animals met with considerable opposition owing to the attitude of the cattle owners who maintained that some animals recovered and became immune.

Pleuro-pneumonia inoculation, although nothing like so satisfactory as the simultaneous method in rinderpest, is considered to be in the writer's experience a beneficial measure in infected areas in those countries where wholesale slaughter is out of the question. The inoculation sometimes has to be performed repeatedly in order to obtain a satisfactory reaction. Glycerinated virus was used. The so-called " thread " method was found to be more convenient in practice than inoculation by means of a syringe. When the inoculation was carried out by the owners themselves gangrene often occurred owing to secondary infection and heavy mortality resulted.

The disease first appeared in the Kalomo district in May 1915, and the heaviest losses took place before the end of July. Measures to eradicate the disease were then undertaken with the result that the last case occurred on November 11th 1916, and no further cases were reported during the following seven months; the possibility of the existence of a few so-called " lungers " is, however, borne in mind.

A few statistics are given,—deaths from pleuro-pneumonia, total 561, deaths after inoculation 644; 9,709 remained alive, apparently after inoculation.

MISCELLANEOUS.

(a) Bovine Haematuria.

Hadwen (Seymour). **Bovine Hematuria.**—*Jl. Amer. Vet. Med. Assoc.* 1917. Sept. Vol. 51. (New Series Vol. 4). No. 6. pp. 822–830.

The condition described by Hadwen is defined as a disease of cattle which appears most frequently at the end of winter and is characterised by the emission of blood of vesical origin in the urine. In 1914 (Report of the Veterinary Director-General of Canada) the author advanced the so-called oxalic acid theory to account for the origin of the disease and a further series of experiments are detailed in this paper in support of his contention.

In the primary stages of the disease the animals show no apparent symptoms except that they urinate more frequently than normally and pass blood at the end of the act of micturition. In the later stages of the disease the animals develop a depraved appetite, become emaciated and anaemic owing to repeated loss of blood and later affected with diarrhoea, and finally die of cachexia. It is difficult to state the average duration of the disease owing to the fact that the earlier symptoms may be overlooked, but as a rule animals do not die within a year after they have first manifested symptoms while in some cases they may live on for years in apparent good health except for the emission of bloody urine. In the late stages of the disease complications may arise especially due to the invasion of the bladder and kidneys by pyogenic cocci. The average age at which animals become affected is 6 years. The disease is associated with poor farm lands such as woodland, newly cleared farms or farms that are either neglected or falling out of cultivation.

The mucous membranes of the urinary tract vary markedly in different cases. Sometimes they are in the form of rough raised red ridges, in others they appear normal except for eroded bleeding patches and sub-mucous haemorrhages. In long-standing chronic cases there is fibrous thickening, a tendency to proliferation and the formation of papillomatous outgrowths. The walls of the bladder may thus lose all power of dilating and in such cases there is an almost constant dribbling of urine containing, as a rule, but little blood. In other chronic cases the bladder becomes permanently dilated owing to the occlusion of the urethra with blood clots. Cicatrices are rarely encountered, showing that as a rule there is no tendency for the lesions to heal. The lesions appear most active towards the end of the housing period, viz., the month of February. The other organs of the body generally appear healthy.

The amount of blood passed with the urine in two cases during 24 hours was found to be 1,101 and 738 c.c. respectively, but it was found that these amounts might diminish considerably from time to time. Clots in the urine are common in the late stages when blood is present in larger quantities; in the early stages the salts in the urine are present in sufficient quantity to prevent coagulation. On sedimentation, as a rule, the red corpuscles have a normal appearance. Haemoglobinuria is sometimes seen in the advanced stages; the urine is generally strongly alkaline in reaction. At first the urine is nearly always sterile but after a time the bladder becomes contaminated especially with streptococci which have also often been found in the kidneys. The calcium oxalate crystals which are believed to play a very important part in the production of the lesions are more abundant in the early stages of the disease.

ROGER, however, notes that the number of crystals is not always a true indication of the amount of oxalate in the urine.

In the early stages the circulating blood appears normal but later the red corpuscles present the usual changes seen in secondary anaemia.

In 1914 the author recorded experiments which showed that oxalic acid was very toxic on drenching but that later on the animals became accustomed to it. It was found that 30 grammes could be safely given daily if the animals were allowed an occasional rest. One cow was thus given 395 such doses but remained in excellent condition and on slaughter the bladder was found to be rough and thick while no other lesions were found in the body. Another cow was given 577 daily doses (May 1914–March 1917) and remained fit and well for up to 2 years and 3 months. Later despite care and extra food the animal gradually declined in condition and commenced passing red urine until she became so weak as to be unable to get up and was slaughtered (March 1917). On post-mortem examination the carcase was thin and dropsical but all the organs appeared normal except one kidney, which was slightly cystic, and the bladder; the mucous membrane of the latter showed petechiae and vegetations and a large quantity of oxalates were found in the red urine.

A steer was given a series of 697 doses (November 1913–March 1917) commencing with small doses at the age of 2 months. The animal remained in very good condition but its growth was distinctly stunted and no symptoms of disease became apparent after this treatment except that albumin and abnormal quantities of crystals were passed in the urine. The author remarks that the feeding of oxalic acid bearing plants would be the best way of reproducing the disease but owing to the difficulty of getting these in sufficient quantity commercial oxalic acid was used.

In 1914 the author claimed to have shown that passage of blood in the urine as in natural cases could be set up experimentally by the irritation provoked by the repeated daily injection of calcium oxalate crystals into the bladder. Three experiments are recorded in which it was shown that injections of dilute oxalic acid solutions into the bladder provoked great irritation and that subsequently the urine was stained with blood. Calcium oxalate crystals were found in the bladder as soon as the acid came into contact with the urine and mucus. After a time the urine became contaminated with bacteria which no doubt played a part in aggravating and maintaining the lesions. Two out of the three cases developed a disease indistinguishable from natural cases of haematuria.

According to the author the only objection MOUSSU raises to his theory is that if haematuria were set up only in consequence of animals eating irritant plants then in the majority of cases they should recover when removed to healthy regions; but MOUSSU admits, however, that it is probable that the lesions once firmly established cannot be cured. As the result of close observation of 66 cases in British Columbia the author himself found that not a single case lived over five years after showing the initial symptoms. Remissions occurred during which periods the animals might appear to be in perfect health but they always broke down again and never lasted for much more than a year. In British Columbia the disease is confined almost entirely to the bench lands bordering on the Pacific. CLELAND noted the same thing in Australia and CASE in Hawaii. The author thus does not hold forth any hope for treating the disease successfully, but recommends prophylactic measures consisting in the agricultural improvement of the pastures grazed over by affected animals.

(b) "RENGUERA."

TABUSSO (M. E.). **Paraplegia enzootica negli agnelli.** [Enzootic Paraplegia in Lambs.]—*Clinica Vet.* 1917. Aug. 31. Vol 40. No. 16. pp. 457–472. With 1 text-fig.

This preliminary communication issued by the Director of the National Institute of Agricultural Microbiology, Lima, deals with a disease affecting almost exclusively lambs in the Andes regions of Peru and known locally under the name of *renguera* (lumbago). Clinically the disease is characterised by disorders of the locomotory system starting as a paresis and ending up with general paralysis. The disease appears to be of a contagious character inasmuch as in infected flocks from 98 to 100 per cent. of the newly born lambs may become infected. The course of the disease lasts on an average from 1 to 2 months although in some cases, especially in very young lambs, it may not extend beyond a fortnight; the disease always terminates fatally, death being brought about not so much by the disease itself as by inanition due to the lambs' inability to feed.

The Peruvian *renguera* was first studied by L. MACCAGNO in the infected regions and his observations corresponded exactly with those of the author. There are very few accounts in veterinary literature of diseases corresponding with this affection. An Argentine observer, J. M. QUEVEDO, has described a group of affections known as *la pataleta* and characterised essentially by cerebro-spinal disturbances, affecting stock in the southern regions of the Argentine and taking the form of localised outbreaks. Enzootic paraplegia of sheep was first studied in 1908 by BABY, who recognised it as a new disease affecting exclusively ovines and showing symptoms comparable to those produced by the administration of repeated doses of a convulsant poison; he further noted that the affected animals grazed over low and marshy pastures and got better when transported to high and dry localities. LIGNIÈRES (1900) denies its contagious nature as no specific microorganism was discoverable. SIVORA (1911) attributed the disease to the toxic effects of the Preisz-Nocard bacillus.

The Argentine *pataleta* (or *tembladera, vértigo, chucho*) first manifested itself in Patagonia in 1907 and attacked horses, cattle, and young lambs, the symptoms in these various species of animals being similar in each case, but sheep were most often attacked. On being urged to run the animals began to tremble in the hind legs as if suffering from paraplegia and before long fell to the ground as if their tendo Achilles had been cut, thus assuming a dog-sitting position; death was due to inanition and the disease was seen especially towards the end of the summer and during the autumn. No lesions were discovered in connection with the nervous system or other tissues and causal organisms could not be demonstrated. QUEVEDO believed that the disease might be due to the ingestion of various Graminaceae and Leguminosae such as *coiron* grass, which is only eaten during periods of great drought. Reference is made to other authors who have studied the disease in other parts of the Argentine. Some of these ascribed the disease to a fungus found on a certain species of grasses. Reference is also made to a paralysis of sheep occurring in South Africa which is believed to be tick transmitted. The author mentions the fact that S. H. GAIGER had been set to work on the disease in infected centres at the time of his writing [see following extract].

In Peru the disease is at present confined to a few provinces in the Department of Junin, forming a tableland situated at an elevation of from 4,000 to 4,500 metres above sea level in the Cordigliera of the Andes and just below the ice line. The climate is cold, varying from $-5°$ C. to $+15°$ C. and has only two clearly defined seasons, viz., one termed winter with a relatively high temperature but with heavy rains and daily storms (October–March) and the very cold summer with hard nocturnal frosts (April–September). The whole zone consists of natural pasturage with a predominance of Graminaceae and is rich in water which comes from the snowclad regions above. The subsoil is very rich in minerals. The pasture is grazed over exclusively by sheep and a few llamas. Each ranch contains on an average from 20,000 to 40,000 sheep distributed over vast stretches of land in groups of several hundred animals living entirely in the open air. In the case of a fresh outbreak in a flock there is always a history of its having been contracted from a neighbouring infected flock; the infected region becomes more extensive every year and at present covers a surface of several thousand square kilometres. The author then gives statistics dealing with the extremely high mortality and serious economic losses caused by the disease in large flocks.

The disease appears to have first appeared in Peru about 1911 as no history of a similar disease can be traced to have existed before that time. The disease cannot be of a digestive or mineral origin as the pastures have remained in the same condition in these districts for centuries. There appears to be good reason to believe that the disease was most probably imported from the Argentine, inasmuch as shortly before it was first reported a few sheep were introduced for the first time for cross-breeding purposes from Patagonia and other neighbouring provinces into the ranches in which the original outbreaks occurred. As stated above, a disease which is probably exactly similar has been studied in the Argentine since 1908. In 1910 there was a large importation of Argentine cattle, horses, sheep, etc., into Peru and these introduced into the country, among other diseases, foot-and-mouth disease.

Animals attacked.—According to shepherds cases of *renguera* are said to have been observed amongst the llamas and sheep dogs in the affected regions but the author doubts the accuracy of these statements. The regions affected communicate with a rich cattle breeding region known as the *sierra* lower down at a height of 3,000 to 3,500 metres and in one ranch situated on the border line a fatal disease corresponding with that seen in lambs was observed affecting three calves. The disease affects sheep of every breed and condition to the same extent but shows a marked predilection as regards age; lambs up to 6 to 8 months old are most susceptible, especially when they are from 2 to 4 months old, but yearlings are also attacked to a less extent. Adults very rarely become affected.

The disease is most prevalent during the rainy season (the local winter), that is, during the period in which lambing mostly takes place. The number of affected animals increases considerably after cold and damp nights.

The following were the more important symptoms observed by the author in the course of a study of naturally occurring outbreaks and a few cases in the laboratory. In typical cases the disease assumes a sub-acute character with an average duration of from 1 to 2 months. In some outbreaks, however, the acute form predominates affecting more than 90 per cent. of susceptible animals, producing a mortality of about 100 per cent., and completing its course within a month. Rarely, cases of a chronic character are seen, terminating fatally after a long period, while in some instances such as with cases transported into a suitable climate and properly nourished, gradual improvement in the symptoms may be seen.

The disease appears to manifest itself suddenly without preliminary symptoms and affects primarily the hind limbs. No cases in which the fore limbs were first affected have been seen. Neither at the beginning nor during the later course of the disease does the affected animal show noteworthy general symptoms. The disease thus begins with lack of co-ordination of the hind quarters, and dragging of the hoofs with consequent lesions on the coronets. The animal remains at the end of the flock and assumes a characteristic posture with the legs apart. Later paresis sets in and when the animal is urged to move the affected legs give way and it falls on its hind quarters or on its side; with some effort the animal soon resumes its standing position, but again falls as before when it attempts to move and after a number of falls rests stretched out on the ground with its hind quarters completely immobile. Next the animal falls so frequently that paraplegia sets in definitively and then death from inanition invariably ensues owing to the inability of the lamb to graze or follow its mother. In acute cases the inco-ordination, paresis, and paralysis are manifested in the fore limbs also and in such acutely affected cases giddiness and trembling are often observed either generalised all over the body or confined to the head. No specific lesions are seen on post-mortem examination. The carcase shows signs of inanition and the muscles of the affected quarters are atrophied. Naked-eye examination of the nervous system showed nothing abnormal except slight congestion of the meninges; in very severe cases congestion of the spinal cord especially the lumbar portion can be observed. The lumbar plexus shows no lesion.

The experimental studies made by the author gave no indication as to the etiology of the disease. Examination for causal organisms either directly or by attempted artificial transmission of the disease always gave negative results. Microscopic examination of the blood in a great number of cases revealed no micro-organisms except a few diplococci in two or three cases. Moreover, it is highly improbable that a protozoan blood parasite can be connected with the disease, inasmuch as it only attacks lambs in a cold region where the ecto-parasites which usually transmit organisms of that kind are completely absent. *Melophagus ovis* is the only widely diffused species. Examination of the cerebro-spinal fluid gave similar results while the smears from the other organs and tissues gave constantly negative results.

A few cases were kept under observation at the laboratory with a view to making cultural examinations. Blood cultures from 15 cases examined after natural death remained sterile or developed growths of the common putrefactive organisms. In three cases the cultures from the cerebro-spinal fluid and from the blood revealed a Gram-positive diplococcus. A large number of haemo-cultures were made from 14 cases studied over a period of two months during the course of the disease. Blood from the jugular vein was thus incubated under aerobic and anaerobic conditions. Ten per cent. of these became accidentally contaminated; 50 per cent. were sterile, the rest, that is to say, 40 per cent. revealed a coccus generally in the form of diplococci and Gram-positive. This organism grows readily, even under anaerobic conditions, on the ordinary culture media and rapidly produces a uniform thin silky-looking film with no special odour. The author does not believe that this organism is responsible for the onset of the disease inasmuch as (1) inoculation into common laboratory animals and healthy lambs failed to reveal any pathogenicity, (2) control experiments showed that an organism identical in appearance could be isolated from healthy lambs living in regions not affected with *renguera*, and these lambs, in which the organism was discoverable, remained healthy for a long period afterwards at the laboratory.

In six cases of the disease examined immediately after death the blood of four gave cultures of the diplococcus and two remained sterile, while similar results were obtained on sowing out the cerebro-spinal fluid. Inoculation of media with the pulp of the enlarged lymphatic glands always gave negative results.

According to the author repeated attempts at transmitting the disease artificially in various ways gave constantly negative results. The author then briefly summarises some of his experiments dealing with the attempted transmission of the disease by cohabitation and inoculation of material suspected to be virulent. In the cohabitation experiments in addition to healthy lambs pregnant ewes were placed with the affected animals in order to determine whether the infection takes place during foetal life. In two experiments transmission by means of ecto-parasites was attempted by placing sheep keds, gathered from affected lambs, on healthy lambs.

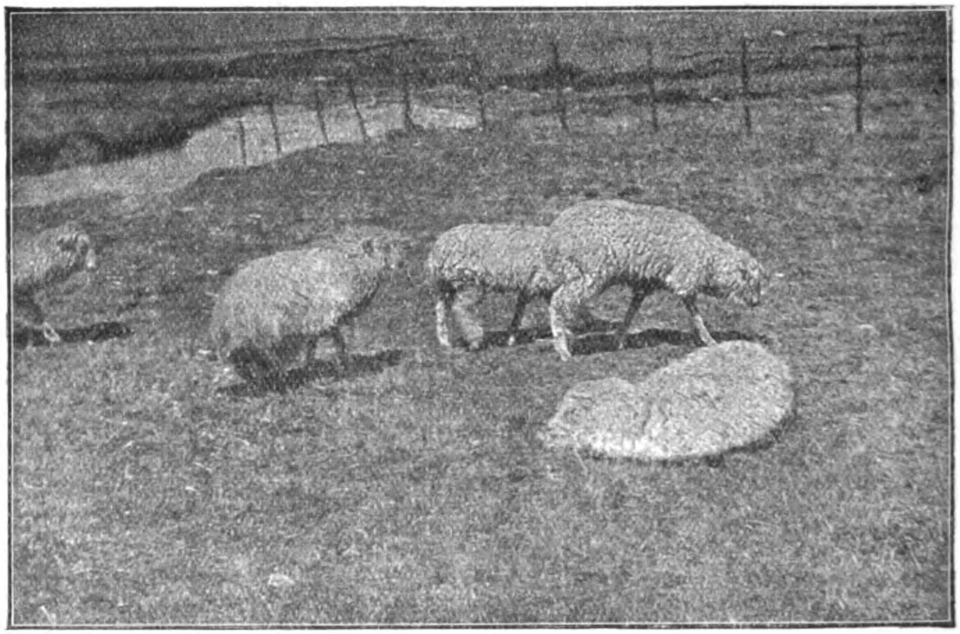
In his conclusions the author states that this paraplegia of lambs reminds one very strongly of infantile paralysis in its endemic form and suggests the probability of its being caused by an ultravisible virus. The only prophylactic measures at present possible are isolation of infected flocks, immediate slaughter of all affected animals, and a change of pasture from low marshy districts to higher, dry regions.

GAIGER (S. H.). **Renguera: A Paralytic Sheep Disease in Peru.**—*Jl. Comp. Path. & Therap.* 1917. Sept. Vol. 30. Pt. 3. pp. 185–209. With 4 text figs.

This paper contains an account of the work done by Gaiger during a visit to Peru in the latter half of 1916 with the object of investigating the disease already discussed in the preceding extract. The work was conducted on behalf of a number of sheep farmers who were suffering very considerable economic losses owing to the large mortality amongst their lambs each year. The laboratory material necessary was taken out from England. Gaiger first gives a good description of the peculiar local geographic and climatic conditions prevailing in Peru together with the sheep-farming customs. The native sheep, which are of a very poor type, are now being improved by crossing, mostly with the Romney Marsh breed. The small laboratory was fitted up on a large sheep farm—Atocsaico Farm, owned by a British company. This farm was situated at an altitude of 14,000 feet and lay on rolling grass country, the Home Farm being situated in a valley on the banks of a small stream.

A brief description is given of the history of the disease. The word *renguera* is said to be probably derived from the Spanish word *rengna* meaning "injured in the back," and Gaiger remarks that there is a complete absence of any reliable information about the origin and spread of the disease, and does not discuss the probable source of its introduction. Owing to the confusion in the classification of sheep diseases the word *renguera* has come to be used in the case of nearly every sick lamb and the losses attributed to it are said to have been grossly exaggerated, although at the same time the disease itself undoubtedly causes very considerable losses.

The disease had been known at Atocsaico for six years. At first the cases were few in number but they became doubled each successive year until in 1915 they amounted to about 700 out of 5,000 lambs born. On neighbouring farms the losses were very much greater and also increasing every year in importance, one farmer stating that he had lost every lamb in 1915 from the disease. The disease was probably first noticed in Peru about 15 years ago. It is stated to occur only in sheep but it was also reported to affect young llamas;



* Fig. 3.

These hoggets were being driven to the right when photographed. In falling they nearly always swing half round and fall facing the opposite direction to that in which they were walking. One is seen with its hind quarters collapsing.

cattle and horses are not susceptible. Symptoms commence in lambs from the age of about 14 days and fresh cases keep on occurring up to the age of 5 to 6 months. The description of the symptoms is similar to that given by Tabusso. A not uncommon symptom in bad cases in lambs is slight up and down trembling of the head and more rarely this symptom extends to the whole body, which shivers as though from cold; a peculiar symptom in these cases is a frequent grinding of the teeth, making a noise which can be heard 10 or 20 yards away. Clinically, renguera is a disease of the nervous system and resembles an intoxication by some poison working on that system.

In 1915 the author believes that a mortality of 8 or 9 per cent. on Atocsaico Farm was caused by the disease, but, owing to the inclusion

* [Reproduced by permission from the *Journal of Comparative Pathology and Therapeutics*.]

of a number of other diseases under the same name the losses were estimated by the farmers to be much higher. Gaiger, also, notes that it is doubtful whether *renguera* of itself would account for many deaths; the cause of death in most cases is inanition produced by the inability to obtain nourishment on account of the paralytic symptoms. In 1916 the mortality was high owing to the prolonged dry season and the lambs were born long before the grass began to grow. It is denied that the mortality is increased by cold and damp for, in 1916, it was exceptionally dry and *renguera* commenced sooner and in younger lambs than ever before.

Owing to the very rapid onset of putrefaction after death it was decided to attach no importance to post-mortem examinations of animals which had died a natural death; even in apparently healthy lambs Gaiger showed that there may be an invasion, especially with the *Bacillus coli*, from the bowels. The lesions discoverable in the more severe cases in young lambs are said to be as follows: (1) increase in the peritoneal, pericardial, and pleural fluids, these being frequently slightly tinged with haemoglobin; (2) a darker colour of the liver in most cases; (3) slight, but never marked, increase in the colouring of the meninges of the brain and spinal cord; (4) occasional catarrhal condition of the small intestine in lambs; and (5) a not infrequent patchy endocarditis.

The disease is compared with other important non-inoculable sheep diseases whose etiology is unknown, viz., louping-ill, scrapie or lumbar prurigo, and swingback in the British Isles, and *pataleta* in Patagonia. Neither scrapie nor louping-ill exist in Peru but both *renguera* and louping-ill probably exist in Patagonia and are confused together under the name of *pataleta*. The clinical symptoms of *renguera* in its most chronic form are indistinguishable from those of swingback in England, and it may be more than a coincidence that *renguera* has appeared in a part of the world where considerable numbers of Romney Marsh sheep have been imported. It is possible to produce symptoms similar to those of *renguera* by injuring the spinal cord with a fine syringe needle at the seat of lumbar puncture but these symptoms only last for a short while. The absence of ticks removed one factor which would have had to be studied as a possible cause, knowing what one does of the action of *Ixodes pilosus* in Cape Colony and *Dermacentor venustus* in British Columbia in producing paralysis in sheep.

No organisms were discoverable in smears from the blood or any of the other tissues or fluids of the body by direct microscopic examination.

The following were the gross parasites found commonly affecting sheep and lambs:—

(1) *Fasciola hepatica*, very common in the liver of practically every sheep examined. They were to be found in lambs from about two months old.

(2) *Dictyocaulus filaria*. Was very common but never in very great numbers. It was also common in the hoggets and found in lambs over two months old.

(3) *Trichocephalus affinis*. Is perhaps the commonest parasite with which sheep are affected, and is present in greater numbers than any other worm. Found in lambs from about 3 weeks old.

(4) *Oesophagostomum radiatum.* Was frequently found but usually in very small numbers.

(5) *Monieza expansa.* Was sometimes present in adult sheep.

(6) *Cysticercus tenuicollis.* Was very frequently present in the mesentery of hoggets and adults.

(7) *Haemonchus contortus.* Was sometimes seen but rarely present in numbers over six or eight in one animal.

None of the above parasites could be blamed for producing such symptoms as those of *renguera*; they were to be found equally numerous in *renguera* animals and apparently healthy animals. Also, neither chemical poisons nor poisonous plants could be blamed and no protozoan infection was discoverable.

The author then gives details of a number of experiments carried out with a view to attempting to transmit the disease artificially. Inoculation experiments with brain, blood, cerebro-spinal fluid, peritoneal fluid, and pericardial fluid all failed to set up any symptoms and feeding experiments likewise remained negative. "Inoculation and feeding experiments having failed to transmit the disease it seemed unnecessary in the absence of ticks to resort to cohabitation experiments to see if the disease could be transmitted in this way."

Gaiger then details a large number of cultural experiments which demonstrated the almost constant association of a micrococcus with the disease. These were performed with great care and under difficulties owing to the low boiling point of water at the high altitude of the sheep farm. The technique adopted in obtaining cerebro-spinal fluid is described. Amongst the cases in the *sierra* the coccus was thus found by cultural experiments to be present in the peritoneal fluid in 30 out of 43, pleural fluid in 4 out of 14, pericardial fluid in 5 out of 14, liver in 11 out of 30, gall bladder in 1 case out of 1, blood in 5 out of 25, central nervous system in 10 out of 38, and brain in 1 out of 5 cases in which it was examined. The coccus is stated to have also been found in cases subsequently examined by TABUSSO in his laboratory at the Agricultural College in Lima. Inoculation experiments with this coccus were made into ten lambs and two rabbits intraperitoneally, intra-spinally, by injection into the nasal cavities, or by feeding, with negative results.

An attempt was made to find the coccus in young healthy lambs on Atocsaico. Five were examined and the coccus was found in two in the peritoneal fluid and in one of these two it was also present in the blood. In the other three healthy lambs the coccus did not grow from any of the fluids or tissues of the body but in one case *Bacillus coli* grew from the peritoneal fluid.

Large doses of culture of the coccus failed to set up the disease and so the author made an attempt to find out whether the symptoms might not be caused by the manufacture of a toxin. Peritoneal fluid from a renguera case was pipetted off into a culture tube and incubated for seven days; 1 c.c. of this fluid inoculated intra-spinally into a lamb produced no apparent ill-effect.

The role of this coccus in the evolution of the disease cannot be determined until one is able to transmit the disease experimentally from infected to healthy animals. The serum of infected animals showed no agglutinative properties for an emulsion of the coccus. With regard to the cultural characters of this coccus the author found that it was sometimes difficult to obtain a first growth from the body fluids. A visible growth was often only obtained after incubation at body temperature for several days. Egg medium was sometimes successful in obtaining a primary growth when other media failed. Sub-cultures grew readily on all ordinary media. There was no growth on gelatin at 20° C. ; in broth the organism produced a turbidity which then settled as a distinct deposit to the bottom of the tube. On agar the growth was a clear shining semi-transparent film without colour. On solid media the first growths from the body were sometimes isolated colonies of which there might be five or six scattered over the surface, but more frequently the growth originated in the water of condensation in the bottom of the tube. The coccus prefers a medium slightly alkaline and will not grow on an acid medium. It is preferably an aerobe but grows fairly well under anaerobic conditions. It produces acid and does not ferment glucose or lactose.

The paper concludes with a discussion of the measures that can be adopted to eradicate the disease. Curative measures hold out little promise of success. In judging the efficiency of preventive measures care must be taken to avoid falling into error as very little has ever been done on the sheep farm in the way of keeping proper statistics. The author's view is that the rise and fall of the disease is solely due to the age of the lambs and that the wet or dry seasons do not exert any distinctive influence except as regards their exceptional severity. Experiments in altering the breeding season are about to be made on Atocsaico to see whether the losses from frosts and starvation will be reduced by having the lambs born in April instead of September and it will be instructive to learn whether *renguera* occurs when the April lambs are a week old or not. Also, experiments are to be made to show the effect of breeding from some of the least affected or "recovered" hoggets and the number of cases which occur among the resulting lambs. Further experiments are to be made to determine the preventive value of inoculation of a serum immune against the coccus into young lambs. All lambs are to be destroyed and buried as soon as they become infected. On one farm it was believed that feeding with a mixture of salt and sulphur produced beneficial results.

(c) Equine Pneumonia.

Watkins-Pitchford (H.). **An Enquiry into the Horse Disease known as Septic or Contagious Pneumonia.**—*Vet. Jl.* 1917. Oct. Vol. 73. No. 10. pp. 345–362. With 6 text figs.

Although the disease above referred to is by no means what is commonly regarded as a tropical disease, it is felt that the subject is of such world-wide veterinary importance and has in the past presented one of the most difficult tasks confronting the investigator into the nature of animal diseases that a brief extract and review of this attempt to solve the problem would not be out of place in this *Bulletin.*

The work undertaken by Watkins-Pitchford was apparently performed by direction of the administrative authorities of the British Army Veterinary Service and the clinical material necessary for the study was afforded by the Swaythling Remount Depot and Veterinary Hospital. The investigation covered a period of eight months, a considerable part of the time being taken up with other duties. It seems unfortunate that research work on a disease which has caused very considerable economic losses among British Army horses should be allotted so small an amount of trained personnel and time.

At the commencement of the report the writer apologises for attempting to construct a "theory upon hazardously meagre data," but then lays down a series of elaborate hypotheses and conclusions in fifty-two numbered paragraphs, at the end of which (para. 52) he "again regrets the hasty and immature nature of the work."

No reference is made to the work of former investigators on the subject and in reality although the author confesses (para. 45) that "he has no adequate works of reference at hand" the style of writing and nature of the argument put forth would strike even the most casual reader with the fact that the large amount of work already done on this difficult question has either been insufficiently consulted or not read at all.

In a brief report furnished in September 1915 the author stated "that no evidence was then forthcoming as to the directly infectious nature of the disease from horse to horse, and the report further aimed at demonstrating the existence of a lengthy and indefinite period of incubation or latency existing between infection and obvious lung involvement."

The same opinion is held in the present report, as can be seen from the following two paragraphs :—

7. "The name of 'Specific' or 'Contagious' Pneumonia, both of which terms are frequently applied to the disease, appear to the writer as misnomers, and there also seems evidence leading to the conclusion that the term 'Septic' is equally inapt as a description of the disease if used in a specific sense.

8. "Recent observations, indeed, suggest the classification of the disease as one of an idiopathic rather than a specific nature, or, perhaps, a standing midway between the two categories, being due to the agency of an organism occasionally present in, but non-pathogenic to, the normal horse, and assuming a pathogenic phase under conditions of lowered vitality in the host which harbours it."

Again in para. 29 a brief summary is given of the theories advanced in the foregoing paragraphs :—

"(a) The great majority of cases of 'specific' pneumonia are preceded by an involvement of the nasal membrane constituting the condition known as 'catarrh.'

"(b) Such antecedent condition of catarrh is induced by depleting physical conditions and not by direct transference of infection from horse to horse.

"(c) Throughout the clinical course of such cases a specific organism is present probably in all, but certainly in the majority of instances, both in the circulating blood and in tissues after death.

"(d) The blood of animals suffering or recovered from either of these diseases acquires a specific property capable of clumping or agglutinating strongly the bacillus in question.

"The conclusion drawn is that an essential connection exists between the ordinary catarrhal and pneumonic attack and the organism which later although usually non-pathogenic to the normal horse, is capable, in circumstances of lowered vitality, of establishing a pathogenic action ultimately leading to grave tissue involvement. . . ."

The organism referred to above and styled the bacillus "x" is stated to resemble closely *B. subtilis*, an organism which is usually regarded as being non-pathogenic. The author, however, claims that there are "certain points of difference in morphology and culture" between these two organisms and details regarding the biological characters of the incriminated organism are promised in a later report. This organism was found in pure culture in "57 per cent. of cases in the circulation of the living animal when suffering from catarrh" . . . "in the sporing condition as well as in the resting stage." [No sign of sporulation is visible in the organisms depicted in photomicrograph 1 and stated to be in the sporing condition.—ED.] The organism was also generally found in pure culture in the pleural membrane and sublying exudate on the surface of the lung in cases which had apparently not reached the so-called septic stage. "Even in the advanced septic stage the bacillus, which appears to be the primary causal organism, can be isolated without difficulty owing to its great resistance to a degree of temperature which kills the other organisms."

"This same organism is present occasionally in the circulating blood of horses not the subject of any catarrhal condition and apparently in normal health," but it is believed that the normal circulating blood does not harbour it indefinitely and that its presence in such cases must be looked upon as a pathogenic phenomenon; animals harbouring this organism are regarded as disease carriers.

The organism presented a striking peculiarity in that it could only be isolated in culture when horse flesh or serum, instead of the usual beef products, was used in the preparation of media.

"The presence of agglutinins in the blood of the horse suffering from, or recovered from, catarrh is demonstrable to a marked degree" and "the agglutinative principle is absent from young equines or only present to a modified degree." [We wonder what the significance of a modified degree of agglutinative principle can be.—ED.] "That this agglutinative power is not entirely dependent on previous catarrhal attack, however, would seem probable from the agglutination of the normal ox and sheep, which although not high, is distinctly present. Such differences between the horse and the ox would appear likely to be due to the presence in the tissues of the former of some substance of a bio-chemical nature, permitting the more vigorous development of the organism in question." [A very comprehensive although extremely vague statement.—ED.]

In giving a brief sketch of what he considers the pathological and clinical picture of the disease the author states *inter alia* (para. 41) "congestion of the lung tissue . . . is attended with embolism and occlusion, and by the lodgment of the organism in the ultimate air passages where the optinum conditions of warmth, stillness, and an adequate supply of oxygen ensures its vigorous proliferation. . . ." However, earlier on (para. 35), in discussing the pathology of the so-called "septic" condition he states that this appears always to be of the nature of a secondary invasion due to "a septic environment such as most stabled horses are liable to. Recognition of this fact obviously furnishes the *rationale* underlying open air treatment of pneumonia where an increased opportunity for oxygenation and freedom from septic environment often prevents the grave condition which ensues in cases where the tissue of the lung becomes septic." [Oxygenation is thus both a markedly deletereous and a beneficial process in that it on the one hand stimulates the growth of the alleged causal organism and on the other hand inhibits a "septic" condition.—ED.]

The author deals finally with the transmission of the disease and his experience leads him to state that "transference by contact, both of pneumonia and the ordinary form of catarrh, appears to fail. Moreover, "the lighter class of horse possesses a considerable degree of immunity as compared with the heavy draught type."

[In this connection more especially it is unfortunate that the protocols of the experiments do not accompany the text inasmuch as they were omitted by the Editor of the journal in which the report is published as they were too voluminous for reproduction. They would in reality have been of fundamental value in judging the merits of the work. It is obvious that the author attempted to carry out his experiments in about the worst possible circumstances. The animals which passed through his hands necessarily possessed no history regarding previous infection and no knowledge could possibly have been obtained regarding their previous history of freedom from infection or infective environment. Satisfactory work could only have been done if such knowledge had been obtainable and proper facilities for isolation and careful observation had been furnished on a scale far more extensive than is obtainable at an ordinary laboratory.—ED.]

REPORTS.

GOLD COAST. **Report of the Accra Laboratory for the Year 1916.** J. W. Scott MACFIE, Pathologist. 115 pp. London: J. & A. Churchill. (pp. 23–28.)

Examinations of Various Animals.

"The routine blood examinations of the animals brought to the slaughter-houses was discontinued in 1916, owing to the reduction of the Staff occasioned by the continuation of the war. No returns have therefore been made of the parasitic infections occurring in the animals slaughtered at Accra; but as this subject was thoroughly investigated in 1915 the omission was a welcome one, because the time that would have been spent over the examinations was able to be devoted to other work.

"Various animals, however, have been examined at the laboratory during the year, namely, 14 antelope, 3 bats, 19 birds, 12 cats, 5 cattle, 16 dogs, 2 fish, 1 frog, 4 goats, 1 hare, 2 hedgehogs, 18 horses and mules, 4 hyaenas, 1 leech, 1 lizard, 3 pigs, 36 rats, 3 sheep, 10 snails, 5 snakes, 11 toads, and 2 wart-hogs: 173 animals in all. No parasites were found in the blood of the bats, cats, fish, frogs, goats, hare, hedgehogs, hyaenas, leech, lizard, pigs, sheep, and wart-hogs.

"A large number of intestinal worms and other parasites were collected from these animals, but these are not referred to below, as no attempt has yet been made to identify them. A considerable number of other animals were also examined for intestinal spirochaetes.

Antelope.

"The 14 antelope examined were five duiker, three hartebeestes, two oribi, one reedbuck, two roan, and one water-buck. Eleven of the specimens were blood films sent by Dr. J. J. Simpson from Yapi, and one a blood film sent by Dr. Allan from Gambaga. Parasites were found in three, namely, a hartebeeste, an oribi, and a reedbuck, all from Dr. Simpson.

"In the blood of the hartebeeste (*Bubalis major*) a few small piroplasms were found which exactly resembled the organisms so common in cattle in West Africa and which are generally known as *Theileria mutans*. Only ring forms were found. In the blood of the oribi an exactly similar infection was found. No Koch's 'blue bodies' were seen in either animal.

"An apparently similar parasite was found by Todd and Wolbach in a roan antelope in the Gambia ('Jl. of Med. Research,' 1912, Vol. 26, p. 195), and the name *Theileria hippotragi* was proposed for this species. The organisms found in the blood of the hartebeeste and oribi referred to above did not differ in any particular from those commonly seen in cattle in the Gold Coast, and as they may have been the same parasite it seems unnecessary to distinguish them by special names.

"A few trypanosomes were found in the blood of the reedbuck. These were polymorphic organisms, and may have been either *T. pecaudi*, the common cattle species, or *T. gambiense*, the human parasite. No forms were found with posteriorly placed nuclei, but this does not really assist in the identification, as such forms, which occur in *T. pecaudi* but not in *T. gambiense*, are very rarely found except after inoculations into the small laboratory animals, such as rats or guinea-pigs.

Birds.

"The 19 birds examined included four swallows, two pigeons, one guinea-fowl, nine domestic fowls, one sparrow, and two other small birds. The only infections found were in the sparrow and the domestic fowls.

"The single sparrow examined was found to be heavily infected with an endoglobular parasite, probably *Haemoproteus danilewski*.

"Spirochaetes, *S. marchouxi*, were found in the blood of seven out of the nine domestic fowls sent for examination.

Cattle.

"A very interesting piroplasm was found in blood films from a cow sent to the laboratory by Dr. E. W. Graham from Tamale, but as this parasite is still under investigation an account of it will have to be deferred.

Dogs.

"Two of the dogs examined were infected with *Babesia canis*, and one of them, a rough-haired terrier, was kept under observation for some weeks and was treated with trypanblau with good results. This dog when first seen was completely paralysed in its hind legs. Under treatment this gradually passed off, but it remained well marked long after all parasites had disappeared from the blood.

"Polymorphic trypanosomes were found in one dog. The animal was said to be very lethargic and always sleeping, he appeared to be unable to recognise familiar voices, he had to be moved forcibly from place to place, and when roused he stood with his legs widely separated. The parasites were probably *T. pecaudi*, but as no posterior nuclear forms were found, and in the absence of inoculation experiments, it is possible that they may have been *T. gambiense*.

"Sheathless filarial embryos were found in one dog.

"Ten dogs were dissected during the year. One animal, which had been found in a moribund condition, had an intussusception of the small intestine. The invaginated part of the gut was gangrenous, and immediately below the site of the intussusception there were innumerable small tapeworms. In another dog, which had been shot because it appeared to be in great pain, the appendix was found to be twisted like a corkscrew and inflamed.

Ankylostomiasis of Dogs.

"In 1915 Yorke and Blacklock recorded the occurrence of *Ancylostoma caninum* and *A. ceylanicum* in dogs at Freetown, Sierra Leone, an infection which they found to be present in all the seven animals they examined ('Annals of Trop. Med. and Parasitol.,' Vol. 9. p. 425). This observation, interesting enough in itself as it is, has a special bearing on human pathology, because one of the parasites, *A. ceylanicum*, has been found in other parts of the world (India, Siam) in the intestine of man.

"The ten dogs dissected at Accra in 1916 were therefore examined carefully for ankylostomes, and four of them were found to be infected.

In each case the species found was *A. ceylanicum*. The dogs at Accra appeared therefore to be less commonly infected with ankylostomes than those at Freetown, and in the ten individuals examined *A. caninum* was not identified.

"Leiper ('Jl. R. Army Med. Corps,' Vol. 24, p. 569) has suggested that Yorke and Blacklock were mistaken in their identification of *A. ceylanicum*, and that they were really dealing with *Uncinaria stenocephala*, a similar ankylostome often found in association with *A. caninum*. The buccal cavity of *Uncinaria stenocephala* is furnished with cutting plates but no teeth, and the dorsal ray ends in three deep digitations, so that a confusion between the two parasites would appear to be almost impossible, and the figures which illustrate the paper by Yorke and Blacklock seem to justify their identification.

"The specimens of *A. ceylanicum* collected at Accra conformed to the description of Yorke and Blacklock and of Lane ('Ind. Jour. Med. Research,' Vol. 4, p. 74), which referred to parasites from Sierra Leone and India respectively. I have been permitted by Professor Stephens to examine some examples of *A. ceylanicum* sent from India by Major Clayton Lane, and have found that they closely resembled those brought from Accra, but appeared to have a narrower dorsal ray. The dorsal rays, however, terminated in three digitations, and not in two, as figured by Leiper.

"In the small number of dogs dissected at Accra, *A. caninum* was not found. Some ankylostomes collected from dogs at Lagos and sent to Professor Stephens in 1913 were identified as *A. caninum*, and recently on re-examining these materials no specimens of *A. ceylanicum* were found. It would be interesting to ascertain by further dissections if *A. caninum* occurs at Accra and *A. ceylanicum* at Lagos.

"One of the dogs found to harbour *A. ceylanicum* had been kept at the laboratory since it was a puppy—that is, for about a year. On 21st January he was noticed to be getting very thin and lethargic, and his blood was therefore examined, but no parasites could be found and no auto-agglutination of the red corpuscles such as occurs in trypanosomiasis. It was noted on this occasion that no eosinophile leucocytes were seen. On 1st February he was again examined, as he was getting worse and was very anaemic. No blood parasites were found. From this time the dog rapidly wasted, and died on 9th February. Blood taken just before death showed no parasites, no eosinophile leucocytes were seen, and a differential leucocyte count (500) gave the following result:—

Polymorphonuclears	84·2 per cent.
Mononuclear cells	15·6 " "
Eosinophiles	0·0 " "
Basophiles	0·2 " "

"On dissection the tissues were found to be very pale, indicating an advanced condition of anaemia, but no gross lesions were found. Both the liver and spleen were enlarged, but smears showed no parasites. Three tapeworms, one *Ascaris*, and a large number of ankylostomes were found in the intestine.

"This case would seem to prove that ankylostomiasis may be a serious disease in dogs, although no doubt, as in man, the parasites may sometimes be present without producing appreciable symptoms of illness.

"As has already been stated, *A. ceylanicum* has not yet been found as a human parasite at Accra, but very few examinations have as yet been made, and the question requires further investigation.

Horses and Mules.

"Trypanosomes were found in two of the horses examined, namely, *T. vivax* in one and *T. congolense* in the other. Neither of the infections occurred at Accra, the blood film from the first having been sent to the laboratory from Gambaga by Dr. Allan, and that from the second from Yapi by Dr. Simpson.

"One mule examined at Accra by Dr. Ingram in December was infected with a polymorphic trypanosome, probably *T. pecaudi*.

Rats.

" Most of the rats examined (32) were Black Rats (*Epimys rattus*) sent to the laboratory by the Medical Officer of Health, but in addition one Pouched Rat (*Cricetomys gambianus*) was examined and three field rats with white bellies and reddish sides of an undetermined species. All the animals were captured at Accra.

" Grahamella bodies were found in eleven of the Black Rats, the Pouched Rat, and two of the field rats. A Bass culture was made with the heart blood of one Black Rat showing these bodies. No increase in the number of bodies was observed, but after 24 hours in some of the cells they were seen to be collected at one side. The bodies were still recognisable on the fourth day, when the experiment was discontinued.

" *Trypanosoma lewisi* was found in six of the Black Rats, and the piroplasm, *N. decumani*, in four Black Rats and two field rats.

" A mite disease to which the experimental white rats were subject is described elsewhere.

Snakes.

" Haemogregarines were found in the blood of two of the five snakes examined, and Dr. Ingram found a *Haemacystidum* in another specimen.

" In addition to these specimens some very interesting materials have been received from Dr. J. E. L. Johnston (Northern Nigeria) and Dr. Corson (Lorha), which unfortunately it has not yet been possible to study. The materials consisted of blood films from snakes showing inclusions in the red corpuscles similar to those which occur in toads, figures of which were given in the Laboratory Report for 1914 (Plate I, figs. 60–62) These bodies are without doubt the same as the 'unidentified Parasite' found by Dutton, Todd, and Tobey ('Annals of Trop. Med. & Parasitol.,' Vol. 1, 1907, p. 287) in a puff-adder caught in the Gambia and in frogs and toads caught in either the Gambia or the Congo, and the same as those found by França in toads from Portuguese Guinea, which he has described under the name *Toddia buffonis* ('Archiv. do Inst. Bacter. Camara Pestana,' III, Fasc. II, p. 229).

" Dr. Johnston's materials also showed a pigmented intra-corpuscular parasite of considerable interest, and a trypanosome.

Toads.

" Eleven specimens of the common toad (*Bufo regularis*) were examined, all in January, but no new parasites were found. Eight of the toads harboured the usual large haemogregarine, and four *T. rotatorium*, a single examination only being made in each case. Three of the animals showed the inclusions referred to above as *Toddia buffonis*."

ASSAM. **Report of the Civil Veterinary Department for the Year 1916-1917.** [HARRIS (W.)]—19 pp. f'cap. With 8 tables. 1917. Shillong: Assam Secretariat Printing Office.

A considerable part of this report is taken up with details regarding general administration and veterinary instruction of Government stipendiaries at the College.

The number of deaths from contagious diseases reported in the various Provinces during the year 1916–1917 was as follows:—

Equines—glanders 2, anthrax 42, surra 26, dourine nil, other contagious diseases 192. Bovines—rinderpest 20,817, foot-and-mouth disease 5,737, haemorrhagic septicaemia 4,245, blackquarter 241, anthrax 1,839, other contagious diseases 12,073. Other animals—rinderpest 498, foot-and-mouth disease 617, haemorrhagic septicaemia 459, blackquarter 61, anthrax 76, distemper 160, rabies 49, other contagious diseases 798.

During the year preventive inoculations by the "serum alone" method were carried out against rinderpest, anthrax, and haemorrhagic septicaemia. The number of inoculations compared with those of the preceding year shows a decrease which is due partly to the smaller number of outbreaks reported and to the reduction in the number of veterinary assistants.

Rinderpest.—Inoculation was carried out in 348 outbreaks in 19 divisions. In these outbreaks 9,633 animals died before inoculation; 29,986 animals were inoculated, of which 571 animals died after inoculation.

Anthrax.—67 outbreaks of suspected anthrax were reported and the disease was definitely diagnosed by microscopic examination in 59 outbreaks. Inoculation was carried out in 47 outbreaks; in these outbreaks 471 animals died before inoculation and 3,814 animals were inoculated, of which 6 died subsequently of the disease.

Haemorrhagic Septicaemia. — Specimens were received from 20 suspected outbreaks and the diagnosis was confirmed by microscopic examination in 16 of these. Inoculation was undertaken in 13 outbreaks; in these outbreaks 80 animals died before inoculation and 2,216 animals were inoculated, of which 1 subsequently died.

Dr. MACALISTER, Imperial Pathologist, Muktesar, visited the country during the year for the purpose of investigating a disease in horses known as *kumri*. This disease attacks and renders useless a considerable number of valuable horses every year and is found in every district. A number of horses were provided for purposes of investigation; MACALISTER'S report has not been published. The numerous tables contain a mass of statistics regarding the prevalence of contagious diseases in the various Provinces and the administration of the Civil Veterinary Department.

BIHAR and ORISSA. **Annual Report of the Civil Veterinary Department for the Year 1916-1917.** [QUINLAN (D.), Superintendent.] — **pp. 3-8. Patna: Superintendent Government Printing. Bihar and Orissa.**

In this report Quinlan gives an account of a very considerable amount of field work performed by a native subordinate veterinary staff under his active supervision. This work was carried out under considerable difficulties owing to the great shortage of assistants and the opposition of the native cattle owners to inoculation and supplying information with regard to outbreaks of disease in their herds. The subordinate staff of the Civil Veterinary Department at the close of the year consisted of seven inspectors and 70 veterinary assistants, but it is hoped that a sufficient number of assistants may be forthcoming when the students from Bihar and Orissa admitted into the Bengal Veterinary College have completed their training. The number of animals treated at veterinary hospitals was 28,180, as against 26,213 in the previous year; the number treated by itinerant veterinary assistants was 55,311 as against 54,904 the previous year. The following is briefly an account of the diseases reported in the Province:—

Equines.—Two outbreaks of glanders occurred, one at Hazaribagh involving 19 cases and another at Angul, Orissa, in which 2 cases were definitely diagnosed. Fifteen deaths from surra were reported from Singhbhum. No details are available regarding other contagious diseases which caused mortality.

Bovines.—As in previous years rinderpest and haemorrhagic septicaemia were the chief causes of cattle mortality. The former was responsible for 19,144 and the latter for 5,584 out of the 26,107 deaths from contagious diseases of all kinds reported during the year. Rinderpest appeared in most of the districts of the Province, the number of outbreaks reported being 1,829, of which about half were attended to by veterinary assistants. 896 outbreaks of haemorrhagic septicaemia causing 5,584 deaths out of 7,330 animals attacked, were brought to the notice of the staff; again only about half of these outbreaks could be attended to.

Foot-and-mouth disease was responsible for 1,748 outbreaks, the number of animals affected being 39,740, out of which only 838 were reported to have died. This disease is regarded as unimportant as it does not of itself usually cause very great mortality unless complications set in.

Blackquarter occurred in 6 districts and affected 166 cattle in 12 outbreaks; there were 164 deaths. 128 deaths from anthrax out of 144 animals attacked were reported from 9 districts. 205 deaths from other contagious diseases are reported but no details are available as to the cause.

Details are given with regard to the inoculation work carried out. The scheme for inoculating cattle through the agency of a special staff of locally trained inoculators, which was introduced as an experiment in 1913, was in force throughout the year in the Ranchi district and, though the number of inoculations for both haemorrhagic septicaemia and rinderpest shows a falling off in some parts of the district, a considerable measure of success was obtained where the missionaries took an active interest in the work of the inoculators. The following table summarises the results of preventive inoculation during the year.

Name of disease.	Method of inoculation.	Number of outbreaks in which inoculation undertaken.	Number of animals which died uninoculated in course of outbreaks.	Number of animals inoculated.	Number of inoculated animals which died of the disease.
Rinderpest .	Serum alone	636	6,689	66,423	288
Haemorrhagic septicaemia.	(a) Serum	141	823	16,521	51
	(b) Vaccine	38	149	4,205	13
Anthrax .	Serum	13	42	1,759	2
Blackquarter.	Vaccine	2	1	210	Nil

In addition 8,982 animals were inoculated against rinderpest and 20,688 against haemorrhagic septicaemia under the Ranchi inoculation scheme.

British East Africa. Department of Agriculture. Annual Report of the Veterinary Department for the Year ending 31st March 1916. [Stordy (R. J.), Chief Veterinary Officer.]—pp. 62–71. Nairobi and Mombasa: Printed at The "Leader."

This report of the Chief Veterinary Officer first gives details regarding the constitution and duties of the staff of the Veterinary

Department during the year 1915–1916. The remainder of the report contains a mass of experience which cannot be extracted with justice and is reprinted as follows :—

"*Disease of Cattle.*—East Coast Fever.—Fresh outbreaks of East Coast Fever have occurred on several farms on the Uasin Gishu Plateau. A Veterinary survey was carried out there, in July and August, 1915, and it was found that, owing to the shortage of immune transport oxen caused by the Military requirements having demanded the purchase of this type of animal, it was impossible to enforce strict quarantine measures as it was necessary, to avoid grave hardship, to maintain transport in the district. There are a good number of dipping tanks already erected on the Plateau, and more are being built, so that it is hoped that it will soon be possible for all animals on the Plateau to be regularly dipped.

"Since the War began, there is evidence that East Coast Fever has spread in the settled areas, and in many cases this can only be attributed to the illicit movement of cattle from infected native reserves, such movement having been stimulated by the shortage of work oxen caused by the War.

"As a result of the heavy mortality recorded amongst cattle drawn from native reserves, collected at various military supply centres, it is evident that in the so-called infected reserves there must be large areas where the disease is non-existent. This only emphasizes the necessity for erecting dipping tanks in these reserves, to check the spread of the disease, and to safeguard the clean herds.

"During the year Government dipping tanks have been completed at Nairobi, and at Rumuruti, and a tank has been erected by the Military Authorities at Fort Ternan. Several private dipping tanks have also been erected, and some 80 are now in use in the Protectorate.

"It has been noticed on several farms where 'redlegged' ticks are prevalent, that those situated inside the ears frequently survive an immersion in the dipping fluid, and the attention of stock owners is drawn to the necessity for frequently dressing the inside of the ears of cattle infested with these ticks with a mixture of lard and Stockholm tar, in order to get rid of them.

"When dipping operations are commenced on heavily infected farms in this country it has been found that a considerable mortality occurs amongst susceptible stock during the first year. This experience is similar to what has been found to occur in Rhodesia, and differs from that of stock owners in South Africa.

"The number of cattle, the property of Settlers, admitted to the East Coast Fever Testing Area at Kamiti during the year was 587. The number of deaths was 24.

"Seventeen adult oxen drawn from the Uasin Gishu Masai Reserve were tested during the year, and all of them proved to be resistant to the disease.

"The following extract from the Government Analyst's report is of considerable interest :—

"During the year 1915, the number of samples of cattle dip analysed and reported upon was 650 against 480 in 1914. The results show no improvement upon those of the previous year as will be seen from the following table.

Percentage Error.	Percentage of Samples.	
	1914.	1915.
0—10	61·4	54·5
11—20	20·6	25·7
21—30	9·2	10·3
31—40	4·0	3·8
41—50	1·5	2·6
Greater than 50	3·3	3·1
Sufficiently correct	61·4	54·5
Dangerously incorrect	18·0	19·8

"It was anticipated that, with more experience, the dip owners would improve upon their record of 1914 in the matter of maintaining their dips approximately correct, but it is apparent from the above comparison that in reality there has been a slight falling off in the skill displayed. Probably the fact that many of the Settlers have left their farms in order to do Military service is quite sufficient explanation and, from this point of view, it is satisfactory that the results are so near to those of the previous year.

"The analytical control of numerous cattle dips in the country has not yet resolved itself into a system. It has been left to the discretion of the owner, how frequently he shall have an analysis made, so that it has happened that whereas some owners have only once or twice submitted samples for analysis others again have sent in up to 32 samples in the year.

"It sufficiently appears from the preceding classification of samples according to the magnitude of their error in strength that considerable improvement should be made in the direction of maintaining dips in a state of efficiency. It is very obvious, from a consideration of the record of individual dips, that the owners are frequently working in the dark as to the capacity of the dip and hence cannot make necessary corrections when they have been informed of their error. The consequence of this is that they immediately send a fresh sample in order to ascertain how far their attempt at correction has succeeded.

"The analysis of arsenical dips costs time and money, and this method of obtaining analysis after every correction, instead of relying upon exact calculations of volume of the dip and accurate measurement of the material added, is taking a grossly unfair advantage of the privilege of free analysis which has so far been afforded the dip owners. It has been conclusively proved that this method of correction by trial, instead of by calculation, is not only expensive to the State, but is also unsuccessful.

"Steps are being taken to encourage the dip owner to acquire an intimate knowledge of the capacity of his dip, and to take a lively interest in the accurate measurement of all intentional and accidental additions and subtractions, and to discourage him from attemptimg to place upon the State the burden of maintaining his dip efficient.

"Attention in previous reports has been drawn to the changes in composition which dips undergo, particularly to the processes of oxidation and reduction.

"There appear to have been about 76 dips under observation during the year—the exact number is doubtful as samples from the same dip are sometimes sent over different signatures and the tracing of these is difficult—and in 47 of these the oxidation has not been very great, the quantity of arsenate formed not having at any time exceeded 25 per cent. of the amount of arsenite present. In 18 dips the arsenate reached a maximum exceeding 25 per cent. but not exceeding 50 per cent. of the arsenite, and in all dips a maximum of arsenate exceeding 50 per cent. was reached. In one case oxidation proceeded so far that there was actually at one period over 2½ times as much arsenate as arsenite present. The cycle of oxidation and reduction was in one case completed twice in the year, in two cases it took approximately nine months; several cases indicated a complete cycle in about 12 months, while in many cases the course of the changes was irregular, and the oxidation did not steadily proceed to a maximum followed by a continuous reduction.

"It has occurred in many cases that a dip has been kept in use long after it has become filthy and thick with dung and mud. There are not lacking indications that these dirty dips are inefficient, even when the analysis indicates a satisfactory arsenic content.

"It is highly probable that compounds of iron with arsenic are formed which have practically no toxic properties. Perhaps further experience will enable a more definite statement to be made as to the amount of mud, etc., which may be tolerated. Several cases of error in sampling have occurred—tins which have been used for measuring out Coopers dipping Fluid have been immediately afterwards used to take a sample from the dip; bottles with a quantity of rinsing water left in have been filled up with the sample, etc. Cases have occurred where the results of analysis have given great surprise to the dip owners, and explanations have been demanded of the Analyst. In these cases the usual sources of error in sampling have been pointed out, and the owner has sometimes recognised one or other as the probable explanation, in other cases no explanation has been forthcoming excepting that some serious miscalculation has been made in making up the dip.

"Rinderpest.—Outbreaks of this disease occurred during the year in the settled areas of Lumbwa, Molo, Londiani, Njoro, Nakuru, Naivasha, Kedong, Ngong, Nairobi, Thika and Machakos. In suppressing these outbreaks the double inoculation method was used at Molo, Nairobi, Thika and Machakos. The other outbreaks were dealt with by the inoculation of serum only. The mortality from double inoculation has proved to be as small as in previous years and there is no doubt that this is the best method for dealing with the disease in this country, owing to the constant danger of the disease being reintroduced from infected native reserves, or through the migration of infected wild game.

"In September, 1915, the Veterinary Pathologist reported that instances had come under his notice which went to prove that the double inoculation of calves under six months old did not always result in the production of a permanent immunity to Rinderpest. A circular letter was therefore issued to all Veterinary Officers informing them that calves which are double inoculated for rinderpest when under the age of six months should not be considered immune and consequently should not be branded A M (this brand signifying active immunity). At a later period when such calves are over six months old they should be again double inoculated and branded as immune.

"A fresh outbreak of Rinderpest occurred amongst the cattle of the Samburu tribe, Northern Frontier District. A temporary quarantine station was therefore formed at Archer's Post and all trade cattle, awaiting release there, were injected with serum and passed on to Rumuruti Quarantine Station where they were again serumed before being passed on to the settled areas.

"At the Fort Ternan Quarantine Station 1,367 Military cattle and 2,328 cattle, the property of settlers and traders, were double inoculated during the year.

"The Laboratory issued the following quantities of serum during the year:—

To Military Authorities, East Africa	42,352
,, ,, Uganda	10,080
Veterinary Department, E.A. Protectorate ..	34,810
,, ,, Uganda	25,032
Settlers and Traders	3,500
Government of Nigeria	10,080
Total ..	125,854

"Anthrax.—Several cases of this disease occurred at Fort Ternan Quarantine Station amongst cattle undergoing quarantine after double inoculation for Rinderpest. The infection in many cases appeared to take place at the site of inoculation and in some cases infected animals lived for 20 days after developing symptoms. There is strong evidence to show that animals may be infected with the bacillus of Anthrax without clinical symptoms of the disease being apparent, and it has been demonstrated, that while this bacillus may be innocuous or at least non-fatal to a number of indigenous animals, the same bacillus may prove highly fatal to others.

"It is by this factor that we might assume Anthrax is carried from animal to animal in the process of double inoculation for Rinderpest. Many no doubt will miss infection, others though infected do not sicken, while others, again, contract Anthrax and die. Cases of anthrax also occurred amongst transport cattle working on the Mumias-Kisumu Road, and in the Nairobi and Kyambu Districts. As this disease is communicable to man and proves frequently fatal, animals intended for human consumption should be carefully inspected and temperatured before slaughter.

"Pleuropneumonia.—A few cases of Pleuropneumonia came under notice among the stock confiscated from the Turkhana. The precautions taken prevented animals from being moved to the settled areas.

"With regard to the quarantine area for this disease in the Masai Reserve every possible precaution is being taken to prevent the spread of the disease from this area, but owing to the large purchases of slaughter oxen which are being made from the Masai for Military purposes the owners of the infected herds may be tempted to evade quarantine restrictions and sell infected animals to the Military.

"Tuberculosis.—No cases of Tuberculosis have been reported this year.

"Contagious Abortion of Cattle.—This disease has come under notice on a few farms in the Molo, Nairobi, Naivasha and Machakos Districts, but it is of such an insidious nature and usually pursues such a mild course in native cattle that it is highly probable that it will be found to be much more widespread than is at present suspected. The disease spreads from farm to farm through infected cattle changing hands and too often unscrupulous farmers conceal the fact that their herds are infected to enable them to dispose of their stock. On the other hand, owing to the mild course it usually follows in native cattle, the disease may be present in a herd without the owner having suspected its existence.

"In Europe and other countries contagious abortion is a very serious disease from the stock breeders' and dairy farmers' point of view, and is the cause of enormous losses to owners of infected herds.

"It is probable that the disease in this country will be found to be a most serious one, should it appear in herds of grade cattle. It is therefore highly advisable that all cattle breeders should take every precaution to safeguard their herds against the disease. Rigorous preventive measures enable the disease to be effectually controlled only in herds that are well looked after, and experience in Europe and other countries goes to prove that for the present, effective legislation cannot be devised.

"The most practical method of preventing the introduction of this disease on to a farm is to submit all newly purchased breeding animals to some months' quarantine on an isolated portion of the farm before they are allowed to commingle with the animals of the homestead.

"In calf cows purchased should be calved down in isolated kraals and not allowed to leave these kraals until the animals have returned to normal health and all uterine discharge has ceased. Only then, after careful disinfection of the cows, should the stud bull be allowed access to them.

"A pamphlet dealing with the whole subject will shortly be issued by the Department.

"Trypanosomiasis.—An outbreak of Trypanosomiasis occurred in June, 1915, amongst settlers' cattle in the Thika District. A Veterinary survey was carried out over the whole district in July and August, when it was found that the disease was being largely disseminated through the agency of the common bloodsucking cattle fly (Stomoxys). The area implicated was placed in quarantine in September, 1915, and since then a Veterinary Officer has been permanently retained in the district, carrying out periodic examinations of all cattle; destroying all animals found to be affected with the disease. The measures to date have been instrumental in reducing the incidence of the disease and there is reason to believe that the disease will be eradicated along the transport routes in the near future when it will be possible to allow freer movement of cattle in the district.

"Foot and Mouth Disease.—An outbreak of this disease occurred at the Laboratory amongst cattle imported from Uganda. Prompt action was taken to segregate the affected herd, and any danger of the disease spreading to the Native Reserve was prevented, through the kindness of the Officer Commanding the Nairobi Defence Force, who kindly supplied an armed guard to patrol the infected area.

"This outbreak gave the Veterinary Pathologist an opportunity to satisfy himself in regard to the virulence of the Uganda form of this disease. It proved to be of a very benign type, and local stock possess a considerable resistance to it.

"Quarter Evil.—Outbreaks of Quarter Evil have been reported in Nyeri, Lumbwa, Nakuru and Kisumu Districts. A vaccine produced at the Laboratory has been used and has given good results.

"*Diseases of Equines.*—Glanders.—Cases of Glanders have occurred in one or two consignments of remounts from South Africa. By application of the Mallein test all affected animals were promptly discovered and destroyed.

"There should be little fear of this disease remaining in the country on account of the care that is being exercised to control and eradicate it.

"Epizootic and Ulcerative Lymphangitis.—It is gratifying to find that very few cases of Epizootic Lymphangitis were noted during the year and there has been a great diminution in the number of Cases of Ulcerative Lymphangitis also. This decrease is mainly due to the fact that practically all the equines in the country came under Veterinary inspection during Military commandeering operations when most of the affected animals were either destroyed or sent to the Laboratory for treatment.

"There are a number of equines infected with Ulcerative Lymphangitis, however, still on the Uasin Gishu Plateau.

"The organism of Ulcerative Lymphangitis is present in the soil throughout the Protectorate. No good cause could be served by keeping this disease on the Schedule of notifiable diseases, and steps were taken to delete this disease from the Diseases of Animals Ordinance.

"Horse Sickness.—This disease was the cause of considerable mortality among Military remounts in the Nairobi, Mbagathi and Bissel Camps.

"Few cases have been reported by farmers during the year but this is probably not due to the disease being less prevalent than formerly, but because owing to the War, fewer animals are to be found on the farms.

"Strangles.—Several consignments of remounts from South Africa arrived at Kilindini infected with Strangles, the disease proving to be of an unusually virulent type. As great care is exercised to prevent any affected animals being sold at the sales of remounts there should be no risk of this disease appearing on farms.

"*Diseases of the Sheep and Goat.*—The principal diseases of the sheep and goat which have come under our notice during the year in the Military flocks have been Nairobi Sheep Disease, contagious foot-rot, verminous gastro-enteritis and contagious pleuro-pneumonia of the goat.

"*Diseases of the Pig.*—Two outbreaks of suspected East African Swine Fever were reported from Nyeri and the Uasin Gishu Plateau, respectively, but these were not confirmed.

"*Diseases of the Dog.*—An outbreak of suspected Rabies was reported from South Kavirondo, but the Veterinary Department had no opportunity to confirm the diagnosis.

"An outbreak was reported from Limoru, but as the suspected animals had been promptly destroyed, a diagnosis was not made."

A few details are added giving statistics regarding the permit system, live-stock importation, trading, branding of stock, together with some general remarks.

British East Africa. **Department of Agriculture. Annual Report of the Veterinary Pathologist for the Year ending 31st March 1916.** [Montgomery (R. Eustace).]—pp. 72–75. Nairobi and Mombasa. Printed at The "Leader."

Unfortunately the greater portion of Montgomery's time during the year under consideration was taken up with work of military importance and thus we are deprived this year of the valuable and interesting information usually furnished in his reports. The present communication gives merely a summary of the results of the large amount of routine work performed at the laboratory. As usual the manufacture of anti-rinderpest serum was undertaken on a large scale, 204,480 doses being prepared during the year.

GOLD COAST. **Report on the Veterinary Department for the Year 1916.** —[O'DEA (M. E.), Acting Veterinary Officer).] 8 pp. f'cap. 1917. Accra: Government Press.

In the absence of a trained veterinary officer the work of the Veterinary Department for the year under consideration was carried out by a small staff under the supervision of a medical officer. This work consisted mostly in the routine inspection of cattle, sheep, and goats arriving at Coomassie, either for slaughter or transportation by rail or road to other towns near the Coast. A small amount of investigation work in connection with outbreaks of anthrax and rinderpest was performed by the medical officers. The brief accounts given regarding the diagnosis and methods of dealing with these diseases show a lack of trained knowledge regarding diseases of animals. A small outbreak of what was probably anthrax among stock passing through Salaga on their way from the Northern Territories was dealt with, apparently successfully. Numerous deaths occurred among horses and cattle travelling from the French dominions through the Northern Territories to the Coast; this epizootic was investigated by a medical officer who reported that this outbreak and other outbreaks in these regions could only be put down to rinderpest. The mortality, however, was much lower than that usually occurring in outbreaks of rinderpest in Europe and in the Transvaal. In spite of the presence of this disease along the cattle routes of the Northern Territories throughout the greater part of the year with its attendant mortality and dislocation of the cattle trade the number of cattle imported into Coomassie for 1916 was 14,799 as against 9,802 for 1915.

TRINIDAD and TOBAGO. **Report of the Government Veterinary Surgeon for the Year 1916.** [MILLER, J. Duncan]. 1 p. f'cap. 1917. Port-of-Spain: Government Printing Office.

This short report gives very little information regarding the diseases prevailing in the island of Trinidad. Most of the Government Veterinary Surgeon's time appears to have been taken up with inspection of live stock imported into the island chiefly from Venezuela. A few cases of anthrax occurred among cattle imported from that country but apart from that disease and strangles in American mules no contagious disease was observed in the imported animals. The island is free from rabies. The diseases observed in the island are stated to be for the most part due to metazoan parasites. A few cases of anthrax have occurred and several outbreaks of influenza among horses. A few details with regard to the prevailing diseases would be interesting.

UNION OF SOUTH AFRICA. **Department of Agriculture. Report of Veterinary Division. 1915-1916.** [GRAY (C. E.). Principal Veterinary Officer.] (Abridged Report in *Vet. Record.* 1917. Nov. 24. Vol. 30. No. 1533. pp. 209-213).

East Coast Fever.—This disease still constitutes the most important problem dealt with by the Veterinary Division and consideration of its distribution in the various Provinces and the means adopted for its eradication embrace about half of the present report.

In the Cape the position with regard to the disease has distinctly improved, the number of infected areas still remaining under quarantine having been reduced to six, included in two districts, and as there has been no serious mortality in these areas during the past twelve months there appears to be good reason for hoping that the disease will shortly be eradicated also from these districts.

In the Transvaal there are 8 districts infected with the disease but in most of these the infected areas are more or less circumscribed.

In Natal the position is by no means so favourable; the disease is so widely distributed that 28 magisterial districts are infected and only 6, which form a comparatively small portion of the total area of the Province, are shown as free from the disease. The situation is perhaps explained by the fact that although dipping tanks have been erected in very large numbers by the farming community this has been done in many cases not so much because the value of dipping has been appreciated but for the purpose of obtaining permits for the movement of cattle. Satisfactory progress is being made in the provision of dipping facilities in the native areas of Natal but the difficulties involved in dipping in such conditions are very considerable.

In the Transkei Territories the operations undertaken for the eradication of the disease in native territory have not yet reached a stage at which good results can be reasonably expected. Difficulty has been found in evolving a system which will induce native owners to dip their cattle. The disease, however, appears to have diminished, there having been only 31 fresh outbreaks as compared with 58 last year. In many districts the mortality amongst adult cattle is no longer serious because most of them have become immune either through inoculation or through having contracted the disease when young, but in all districts in which the disease has become established there is a heavy mortality among young stock, varying from 30 to 80 per cent., which keeps up veld infection and perpetuates the disease. In those districts in which European farmers have settled the position is better.

Dipping operations were seriously interfered with throughout the Union on account of the high price of dipping material; arsenite of soda was at one time unprocurable and thus for a time the dipping of cattle in infected areas was in danger of coming to a standstill. In the Cape Province there is a very unfortunate lack of interest in the erection of dipping tanks considering the constant liability to invasion with the disease. The position in the Transvaal is not better, although very considerable losses have been caused in the past. In Natal the number of tanks erected is relatively very much greater, though still insufficient, and it is hoped that in time the majority of farmers will appreciate the benefits of cattle dipping as a reward for their enterprise. In the Transkei the erection of tanks proceeds steadily; in the Orange Free State the number of tanks has also been nearly doubled.

Tuberculosis.—This comes next to East Coast fever in order of economic importance. Legislation has been introduced both for empowering the application of the tuberculin test overseas in the case of animals intended for import and also for dealing with reacting animals already imported from overseas. There is still a lack of co-operation between stockowners and the authorities which tends to defeat all efforts made by the Department to deal in a satisfactory manner with outbreaks of disease. Details are given concerning the methods employed in dealing with outbreaks in the various provinces.

Anthrax.—The losses from this disease are believed to be even greater than those due to gall-lamziekte, which, however, engages the attention of farmers far more considerably. It is pointed out that the former is nevertheless a preventible disease which can be controlled and stamped out by inoculation. In the Cape Province the disease is extending and as no determined effort is made for its suppression the losses will probably be greater than they have been in the past. The employment of vaccins has in some instances been resorted to but much too late in the scene of outbreaks. It is also believed that better success would attend inoculation by increasing the volume of the doses. In the Transvaal and Orange Free State anthrax is becoming increasingly prevalent while in Natal and in the Transkei the losses have not been heavy.

Glanders.—The number of outbreaks recorded and dealt with were as follows :—Cape 22, Transvaal 63, Natal 9, Transkei 5, and Orange Free State 6.

Lung sickness.—There were no fresh outbreaks in the Cape Province. In the Transvaal there was one outbreak : 2 animals were destroyed and found to be infected but no further cases occurred among the in-contacts. In the Transkei two outbreaks were dealt with, neither of which was of much importance, only 3 animals being infected.

Equine scabies (mange).—In the Cape this disease was very prevalent in the vicinity of Port Elizabeth, but otherwise it gave very little trouble. In the Transvaal there were 5, Natal 11, Transkei 14, and Orange Free State 4 outbreaks.

Epizootic lymphangitis.—In the Cape five infected equines were destroyed ; in the Transvaal one animal was found infected and in Natal there were five outbreaks. The position so far as this disease is concerned has greatly improved of late years.

Contagious abortion.—The number of outbreaks reported was 31, distributed in Transvaal 8, Natal 10, Transkei 8, Orange Free State 5. The distribution and character of the disease is, however, admittedly very little understood, and no satisfactory method of dealing with it has been evolved.

Trypanosomiasis.—This does not appear to have spread to any extent outside the fly area.

Some short notes on the following non-proclaimed diseases were furnished by the Senior Veterinary Officer, Capetown [Dixon (R. W.)].

Blue-tongue in sheep.—This does not seem to have been very much in evidence except in the Western Province where in parts it was very prevalent. The diminution in frequency of the disease was attributed to the scarcity in rainfall during the year.

Ephemeral fever (*Three days' sickness*).—This disease was prevalent throughout the Province and in some districts it was particularly severe, as many as 40 to 50 animals in a herd being attacked at one time. Very few cases proved fatal.

Lamziekte.—Appears still to be confined to the sour grass veld area and cases among milch cows and heifers in calf make their appearance during prolonged drought.

Geel-Dikkop.—"**This disease, which attacks both sheep and goats and is mainly confined to the Karroo districts, was prevalent this summer in the**

Northern and North-Western Karroo districts, causing considerable mortality. It appears about the same time as blue tongue, although it is observed that, unlike blue tongue, when the rains are copious and persistent, geel dikkop is not so prevalent. Repeated rain showers followed by hot days are the weather conditions most favourable for its development.

"All attempts to produce the disease by inoculation have failed, also feeding experiments with suspected plants. As the true nature and cause of Geel-Dikkop are unknown, it is hoped that the Director of Veterinary Research will, by investigation, elucidate the cause.

"Medical treatment is found successful when the affected animals are treated early. . . .

"Geel-Dikkop has also been rather prevalent in the Orange Free State. There has been no opportunity of making any investigation respecting the so-called White Liver in sheep.

"*In the Transkei* the past horse-sickness season has been remarkably mild. The same applies to blue tongue. A peculiar form of bone disease in donkeys occurring in East Griqualand is now being investigated by the Research Division."

Further details are added concerning the duties and position of the Staff of the Veterinary Division.

Book Reviews.

LAVERAN (A.). **Leishmanioses. Kala-azar. Bouton d'Orient. Leishmaniose Américaine.**—iii + 521 pp. With 40 text figs. and 6 plates (2 coloured). 1917. Paris: Masson et Cie. [Price 15 francs].

Although 14 years only have passed since the discovery of *Leishmania donovani* and *L. tropica* a very large number of papers have been published on these protozoa and the diseases produced by them ; these articles are, however, to be found distributed throughout a large number of periodicals which are often only obtainable with difficulty. Laveran thus believes that the time has come to summarise our actual knowledge concerning the leishmaniases. The present work is set out according to the following plan :—

(1) Leishmania and leishmaniases in general.

(2) Human visceral leishmaniasis or kala azar, caused by *Leishmania donovani* ; infantile kala azar, which was formerly considered by a large number of observers as a morbid entity, is identified with Indian kala azar.

(3) Naturally-occurring canine visceral leishmaniasis, probably of the same nature as kala azar.

(4) Cutaneous leishmaniasis or oriental boil, caused by *Leishmania tropica*.

(5) American leishmaniasis of the skin and mucous membranes, which is described as a variety of ordinary cutaneous leishmaniasis or oriental boil.

As can be seen from the above summary the book refers mainly to conditions of interest in human tropical medicine, whereas hitherto only one of the domesticated animals, viz., the dog, has been definitely associated with these conditions. Inasmuch as the infection of this animal, however, is probably closely connected with that of human kala azar, especially in the case of infantile leishmaniasis, Laveran considers that a study of the subject is of interest to veterinarians as well as to medical men.

The leishmaniases are not new diseases. The Aleppo button or oriental boil was known towards the middle of the 18th century while kala azar, which was described for the first time in 1882, probably had existed for a long period in the mountains of Garo in India. But, although these human diseases had been recognised clinically, their etiology was not discovered until 1903, when it was shown that kala azar and oriental boil were set up by micro-organisms, closely related to one another and belonging to a new genus of protozoa. Investigations carried out since that date have shown that leishmaniases are not rare diseases confined to a small number of districts in the tropics but on the contrary have a widespread distribution over the surface of the globe, not only in Asia and Africa but also in Southern Europe and a large part of South America, and probably the extent of our knowledge with regard to their geographical distribution is as yet by no means complete. Moreover, as they refer to diseases which run a chronic course and thus usually enable an affected subject to travel considerable distances opportunities may be given to observe them beyond the limits of the endemic or enzootic centres.

By far the greater part of the book refers to the above human diseases which have recently assumed considerable importance. The veterinarian will, nevertheless, find of great interest the chapter on generalities (pp. 1–44) and that on visceral canine leishmaniasis (pp. 279–303) as well as a couple of pages devoted to cutaneous natural leishmaniasis of the dog (pp. 344–346). In the chapter on generalities Laveran gives a clear and critical review of what has recently appeared in the literature concerning the history, geographical distribution, and clinical forms of leishmaniases, technique for the study of Leishmania, both by staining and by culture, and general morphology and biology of the Leishmania. The position of the Leishmania in the nomenclature of the protozoa is discussed in detail and attention is especially called to the hypotheses which suggest themselves as the result of the recent work of FANTHAM and A. PORTER [see this *Bulletin*, 1916, Vol. 4, No. 4, p. 146] and LAVERAN and FRANCHINI [see this *Bulletin*, 1914, Vol. 2, pp. 93 & 193]. According to FANTHAM and PORTER the different species of Leishmania are probably insect flagellates which have become adapted to intra-cellular life in man and other vertebrate hosts and ordinarily propagate under a flagellate form but are capable of resuming the Herpetomas form in certain conditions (for example, in culture media). " From the phylogenetic point of view the relationship between Herpetomas of insects and Leishmania does not appear to be in doubt as can be judged from these experiments. From the point of view of nomenclature, as Minchin has pointed out, the evolution of Leishmania, which are intra-cellular parasites in the vertebrate host, appears too different from that of Herpetomas, which accomplishes the whole of its evolution in the digestive tract of insects, to enable one to amalgamate the two genera."

The following few remarks on the subject of natural canine leishmaniases are taken from the preliminary chapter:—

" Leishmaniases show themselves in the dog as in the case of man under two different forms: the visceral form and the cutaneous form.

" Canine visceral leishmaniasis is much the more common form. The principal and often the only symptom is furnished by wasting; in some animals one observes towards the end of the disease paresis of the hind quarters. The spleen which is almost always increased in size is sometimes very greatly hypertrophied. The disease terminates sometimes in recovery, sometimes in death with sub-normal temperature. It is especially in the bone marrow and next in the spleen and the liver where the Leishmania are found in largest numbers. Natural canine leishmaniasis is encountered in all the regions of the Mediterranean basin where kala azar is endemic; moreover, the Leishmania of the canine infection are indistinguishable morphologically from *Leishmania donovani*; the probabilities are therefore great in favour of the identity of visceral leishmaniasis of the dog with kala azar. This statement must, however, be taken with reserve; the relationship between the frequency of canine leishmaniasis and human leishmaniasis is inconstant; canine leishmaniasis is of common occurrence in regions where kala azar does not exist, and, on the other hand, it is altogether absent in India, that is to say, in the country where human kala azar rages with greatest intensity; in addition one seldom observes dogs infected with leishmaniasis in the habitations of human subjects affected with kala azar.

" Cutaneous leishmaniasis of the dog is encountered as a natural infection in certain parts of the world; it is particularly common in Teheran and has been described in Aleppo, Turkestan, and the Caucasus. The descriptions given of this condition are very incomplete."

Experimentally the dog, the macaque, the white mouse, and some other small rodents are susceptible to infection with the viruses of kala azar and oriental boil.

It is, of course, unnecessary to discuss the merits of this book as regards style and masterly treatment of the subject dealt with. Laveran's writings are sufficiently known to all interested in tropical medicine, and the present work forms a companion volume well up to the high level set in the standard text book on "Trypanosomes and Trypanosomiasis."

J. T. E.

i. LEESE (A. S.) [M.R.C.V.S. (Temporary Captain, Army Veterinary Corps. Camel Specialist to Government of India, 1907 to 1913, and to Government of East Africa Protectorate, 1913–1914)]. **"Tips" on Camels for Veterinary Surgeons on Active Service**—50 pp. (Reprinted from "*The Veterinary Journal.*") 1918. Ballière, Tindall & Cox. [Price 2*s*. 6*d*. net.]

ii. CROSS (H. E.) [M.R.C.V.S., D.V.H., A.Sc. (Indian Civil Veterinary Department, Camel Specialist to the Punjab Government).] **The Camel and its Diseases. Being Notes for Veterinary Surgeons and Commandants of Camel Corps.**—viii + 151 pp. 1917. London: London: Ballière, Tindall & Cox. [Price 5*s*. net.]

The need for a small handy text-book on the more common camel diseases has now arisen owing to the employment of a number of veterinary surgeons, previously unacquainted with the peculiarities of the camel, in theatres of war where this animal figures largely as a means for transport and riding. No better authorities could have been chosen for the work than the above two authors who have been afforded ample opportunity for studying the camel in its native habitat and have already established their names in this connection on account of the reports and communications they have furnished from time to time.

i. This brochure embraces a series of articles which have recently appeared in the *Veterinary Journal*. In his preface the author states that "they were intended for the professional man, the idea being to supply such information on the diseases of camels as have not hitherto been accessible to veterinarians in a concise form, and to avoid long descriptions, both of well-known diseases like Sarcoptic mange, and of matters already quite familiar to the general veterinary practitioner; the subject is dealt with throughout on comparative lines." He concludes by saying that the "paper is admittedly only a superficial one, and has been written from memory only . . . in the back-country of Somaliland, and all my notes and records are at home. . . . No attempt has been made . . . to deal with anything but the male working camel from the point of view of the veterinary officer on active service; nor have I thought it necessary to mention certain diseases of purely local importance."

No apology need, however, be given for producing these notes at the present time and the author deserves well for placing in a condensed form the experience which he has acquired in various countries as the result of careful observation. The advice given throughout is set out in clear, unhesitating terms and should be of great value to the uninitiated in avoiding many errors which would otherwise occur. Vernacular names for diseases have been almost altogether avoided. There are signs in many places that a somewhat unnecessarily colloquial style of writing has been adopted. Indeed, perhaps the greatest possible fault of the book lies in its title. It appears quite unnecessary to place scientific advice intended for professional men on the same level as that obtainable from the parasites of a racecourse. In other places the author's expressions are somewhat ambiguous. For instance, in dealing with the surgical diseases, he includes among "the characteristic camel-lamenesses of the fore-limb" such conditions as "punctured wounds of foot" and "fracture of radius." He must surely mean that these are the "more common" and not the "characteristic" surgical diseases of camels.

It is much to be hoped that some day the author will have access to his notes and records and thus compile a more careful systematic review of camel diseases.

ii. This small volume deals with camel management and diseases in a concise, systematic and comprehensive manner. The text is aided with a number of good photographs and the publishers' work throughout has been very well done. The descriptions are apparently applicable more particularly to conditions as they exist in India and native terminology is used to a considerable extent in the text; appendices are added on the vernacular names of diseases and of fodder fed to camels in the Punjab. The chapter on camel-breeding by Major G. E. M. HOGG, Commandant 54th Silladar Camel Corps, is written in a very light, somewhat airy style and should prove of some interest. A good deal of prominence is given to the author's own recent experiments on feeding and on the attempted transmission of haemorrhagic septicaemia and blackquarter to the camel.

J. T. E.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 5, No. 3, pp. 214–220.]

PROTOZOAN PARASITES.

BÉKENSKY. Les Spirochètes des tractus intestinal des oiseaux. [Spirochaetes of the Intestinal Tract of Birds.]—*Bull. Soc. Cent. Méd. Vét.* July 5. *Rec. Méd. Vét.*, 1917. July 30. Vol. 92. No. 14. pp. 284–288.

HAHN (C. W.). On the Sporozoon Parasites of the Fishes of Woods Hole and Vicinity. III. On the *Chloromyxum clupeidae* of *Clupea harengus* (Young), *Pomolobus pseudoharengus* (Young), and *P. aestivalis* (Young).—*Jl. Parasit.*, 1917. Sept. Vol. 4. No. 1. pp. 13–20.

KAMM (Minnie Watson). Notes on Known Gregarines.—*Jl. Parasit.*, 1917. Sept. Vol. 4. No. 1. pp. 40–43. With 3 figs.

MARTOGLIO (F.). Su di un nuovo genere di parassiti del sangue. [A New Genus of Blood Parasite.]—*Ann. d'Igiene*, 1917. Sept. 30. Vol. 27. No. 9. pp. 561–563. With 1 plate.

ROGER (Henri). Les cas français de Sodoku, toxi-infection par morsure de rat. [French Cases of Sodoku—Toxi Infection by Rat-Bite.]—*Rec. Méd. Vét.*, 1917. July 15. Vol. 92. No. 13. pp. 376–378. [Extracted from *Presse Médicale*, 1917. Apr. 5.]

SAMPSON (S. E.). Coccidiosis in the Horse.—*Vet. Record*, 1917. Sept. 29. Vol. 30. No. 1525. p. 131.

[A four-year-old horse was slaughtered at Sheffield on account of emaciation, and on post-mortem examination the mucous membrane of the small intestine was thickened and the mesenteric glands enlarged and congested. The mucous membrane was found invaded with "large numbers of a coccidian parasite" which was "circular in shape" and "measured only 3 mm. in diameter." (It seems incredible that a coccidium of such dimensions was discoverable as they by no means correspond with those of the coccidia pathogenic for the other domesticated animals.)—ED.]

SUSTMANN. Kokzidiose bei einem Dompfaff. [Coccidiosis in a Bullfinch.] —*Berlin. Tier. Woch.*, 1917. Sept. 27. Vol. 33. No. 39. p. 427.

SUSTMANN. Die Kokzidiose als Ursache des Jungtiersterbens unter den Kaninchen. [Coccidiosis as the Cause of Death among Young Rabbits.]—*Berlin. Tier. Woch.*, 1917. Aug. 23. Vol. 33. No. 34. pp. 375–376.

METAZOAN PARASITES.

Arthropods (Acari, Flies, Ticks).

BEYRO (A. F.). Perjuicos causados por la Garrapata del Ganado Vacuno-Inmunizacion contra la Tristeza: Lo que se hace en Estados Unidos. [Losses of Cattle caused by Ticks: What is being done in the United States.]—*Anales Soc. Rural Argentina*, 1917. June 4. Vol. 51. No. 4. pp. 329–333. With 1 fig.

BRUCE (E. A.). A New Parasite for Cattle. The Larvae of *Eristalis Tenax L.* (Drone-Fly).—*Jl. Amer. Vet. Med. Assoc.*, 1917. Oct. Vol. 52. (New Series. Vol. 5.) No. 1. pp. 66–68. With 1 fig.

CAMERON (A. E.). The Relation of Soil Insects to Climatic Conditions.—*Agric. Gaz.* (Canada), 1917. Aug. Vol. 4. No. 8. pp. 663–669.

CHANDLER (Wallace L.). Investigations of the Value of Nitrobenzol as a Parasiticide, with Notes on its Use in collecting External Parasites. —*Jl. Parasit.*, 1917. Sept. Vol. 4. No. 1. pp. 27–32.

DESCAZEAUX & LAUGIER. Notes complémentaires sur le traitement de la gale par les bains. [Supplementary Notes on the Treatment of Mange by means of Baths.]—*Bull. Soc. Cent. Méd. Vét.*, 1917. July 5. *Rec. Méd. Vét.*, 1917. July 30. Vol. 92. No. 14. pp. 267–271.

DIOS (R.). Sistemática y Biologia de los Ixodideos Argentinos: Contribución a su Estudio. [Biology and Systematic Description of Argentine Ixodidae: Contribution to their Study.]—*Anales Soc. Rural Argentina*, 1917. May 3. Vol. 51. Nos. 3. pp. 249–251.

FROGGATT (W. W. & J. L.). Sheep-Maggot Flies, No. 3.—*Dept. Agric. N.S.W., Sydney.* Farmers' Bull. No. 113. 1917. June. 37 pp. With 12 figs.

HERMS (William B.). Contribution to the Life-History and Habits of the Spinose Ear Tick, *Ornithodoros megnini.*—*Jl. Econom. Entomol.* 1917. Aug. Vol. 10. No. 4. pp. 407–411.

HILTON (W. A.). The Central Nervous System of the Parasitic Isopod, Grapsicephon.—*Jl. Parasit.*, 1917. Sept. Vol. 4. No. 1. pp. 25–26. With 1 plate comprising 6 figs.

IMES (M.). The Sheep Tick and its Eradication by Dipping.—*U.S. Dept Agric.* Farmers' Bulletin. No. 798. 1917. May. 31 pp. With 15 text figs.

KEILIN (D.). Recherches sur les Anthomyides à Larves Carnivores. [Investigations on Anthomyidae with Carnivorous Larvae.]—*Parasitology*, 1917. May. Vol. 9. No. 3. pp. 325–450. With 41 figs, and 10 plates comprising 62 figs.

LAMSON, Jr. (G. H.). The Life-Histories of Cattle Lice.—*Jl. Econom. Entomol.*, 1917. Aug. Vol. 10. No. 4. pp.446-447.

LENEVEU. L'urémie d'origine acarienne chez le cheval. [Uraemia following on Mange in the Horse.]—*Rec. Méd. Vét.*, 1917. Sept. 15. Vol. 93. No. 17. pp. 477–481.

MENDOZA (P. de la C.). La Garrapata en el Paraguay. [The Tick in Paraguay.]—*Anales Soc. Rural Argentina*, 1917. May. Vol. 51. No. 3. pp. 251–253.

DE NAPOLI (Ferdinando). Per la cura rapida della scabbia. [Rapid Treatment of Mange.]—*Clinica Vet.*, 1917. Oct. 15. Vol. 40. No. 19. pp. 573–574.

ROUBAUD (E.). Auto-inoculation et Développement primaire dans les Muqueuses buccales, de la Larve du Gastrophile equin (Oestre du Cheval). [The Entrance and Primary Development of the Larva of *Gastrophilus equi* in the Buccal Mucosa.]—*C.R. Acad. Sci.*, 1917. Mar. 12. Vol. 164. No. 11. pp. 453–456.

SMITH (E. I.). Tick Eradication.—*Jl. Amer. Vet. Med. Assoc.*, 1917. Sept. Vol. 51. (New Ser. Vol. 4.) No. 6. pp. 779–786. With 4 figs.

WOOD (H. P.). The Chicken Mite: its Life-History and Habits.—*U.S. Dept. Agric.*, 1917. Aug. 10. Bulletin No. 553. 14 pp. With 1 plate and 2 text figs.

Helminths.

BIRCH (R. R.). A Serum Test influenced by Ascaris Infestation.—*Jl. Amer. Vet. Med. Assoc.*, 1917. Aug. Vol. 51 (New Series. Vol. 4). No. 5. pp. 694–696.

BOYNTON (William Hutchins) & WHARTON (Lawrence D.). A Fatal Parasitic Infestation in a Herd of Cattle and Goats in Ambos Camarines Province.—*Philippine Jl. Sci.*, 1916. Nov. Vol. 11. Sec. B. No. 6. pp. 285–290.

COOPER (A. R.). A Morphological study of Bothriocephalid Cestodes from Fishes.—*Jl. Parasit.*, 1917. Sept. Vol. 4. No. 1. pp. 33–39. With 2 plates comprising 21 figs.

HALL (Maurice C.). A New and Economically Important Tapeworm *Multiceps gaigeri* from the Dog.—Reprint from *Jl. Amer. Vet. Med. Assoc.*, 1916. Nov.

——. A Synoptical Key to the Adult Taenioid Cestodes of the Dog, Cat, and some related Carnivores.—Reprint from *Jl. Amer. Vet. Med. Assoc*,. 1916. Dec.

——. American Records of *Dioctophyme Renale.*—Reprint from *Jl. Amer. Vet. Med. Assoc.*, 1916. Dec.

——. The Medicinal Treatment of Parasitic Diseases—an Undeveloped Field of Veterinary Medicine.—*Jl. Amer. Vet. Med. Assoc.*, 1917. Jan. Vol. 50 (New Series. Vol. 3). No. 5. pp. 608–611.

——. Parasites of the Dog in Michigan.—*Jl. Amer. Vet. Med. Assoc.*. 1917. June. Vol. 51 (New Series. Vol. 4). No. 3. pp. 383–396,

RAILLIET. Sur deux Nématodes observés en Guinée française par M. Donnat. [Two Nematodes observed in French Guinea by M.D. (= *Oxyuris equi* Schrank in the Horse, and *Spirocerca sanguinolenta* Rud. in the Dog).]—*Bull. Soc. Cent. Méd. Vét.*, 1917. July 5. *Rec. Méd. Vét.*, 1917. July 30. Vol. 92. No. 14. pp. 255–259.

SCHEBITZ. Distomatose beim Pferd. [Liver Fluke in the Horse]—*Berlin. Tier. Woch.*, 1917. Aug. 2. Vol. 33. No. 31. pp. 346–347.

WARD (Henry B.). On the Structure and Classification of North American Parasitic Worms.—*Jl. Parasit.*, 1917. Sept. Vol. 4. No. 1. pp. 1–11. With 1 plate comprising 14 figs.

WICKWARE (A. B.). Intestinal Parasites of Poultry, their Prevention and Treatment.—*Dominion of Canada. Dept. of Agric. Health of Animals Branch. Bull. No.* 25. 13 pp. With 3 plates. 1917. Ottawa.

MYCOTIC DISEASES.

BELIN. Traitement des lymphangites épizootique et ulcéreuse par l'autopyothérapie. [Treatment of Epizootic and Ulcerative Lymphangitis by means of Autopyotherapy.]—*Bull. Soc. Cent. Méd. Vét. Rec. Méd. Vét.*, 1917. Sept. 30. Vol. 93. No. 18. pp. 346–362.

LÓPEZ Y LÓPEZ (C.). Cultivo del Discomyces o *Actinomyces bovis.* [Cultivation of the Discomyces or *Actinomyces bovis.*]—*Rev. Hig. y Sanid. Pecuarias*, 1917. Oct. 1. Vol. 7. No. 7. pp. 353–357. With 3 figs.

RULLMANN (W.). Weitere Angaben über die Unterscheidung der drei Genera Cladothrix, Streptothrix und Actinomyces. [Differential Characters of the Three Genera, C., S., and A.]—*Cent. f. Bakt.* I. Abt. Orig. 1917. June 28. Vol. 79. No. 6. pp. 383–390. With 1 plate comprising 11 figs.

VELU (H.). Nouvelles recherches sur la Pyothérapie de la Lymphangite épizootique. [Further Researches on the Pyotherapy of Epizootic Lymphangitis.]—*Bull. Soc. Path. Exot.*, 1917. Oct. Vol. 10. No. 8. pp. 681–684.

DISEASES DUE TO FILTERABLE VIRUSES.

BECK (Aladar). Infektiöse Anämie der Pferde. [Equine Infectious Anaemia.]—*Berlin. Tier. Woch.*, 1917. Oct. 4. Vol. 33. No. 40. p. 437. [Extracted from *Allatorvosi Lapok*, 1917. No. 35.]

BOYNTON (William Hutchins). Rinderpest in Swine with Experiments upon its Transmission from Cattle and Carabaos to Swine and vice versa.—*Philippine Jl. Sci.*, 1916. Sept. Vol. 11. Sec B. No. 5. pp. 215–263. With 10 figs. and 2 plates.

[The subject-matter of the above paper has already been abstracted from another journal, see this *Bulletin*, Vol. 5, No. 1, pp. 48–52.]

BURMEISTER (W. H.). Effect of the Injection of Nonspecific Foreign Substances on the Course of Experimental Rabies.—*Jl. Infect. Dis.*, 1917. July. Vol. 21. No. 1. pp. 95–107.

CAMUS (L.). De l'immunité déterminée par la vaccination. [The Immunity set up by Vaccination.]—*C. R. Acad. Sci.*, 1917. May 29. *Rev. Gén. Méd. Vét.*, 1917. Sept. 15. Vol. 26. No. 309. pp. 447–448.

CHALMERS (Albert J.) & ARCHIBALD (R. G.). Localized Gangrenous Vaccinia.—*Jl. Trop. Med. & Hyg.*, 1917. Oct. 1. Vol. 20. No. 19. pp. 217–218.

HALLENBERGER (Otto). Zur Komplementbindung bei Variola. [Complement Fixation in Variola.]—*Berlin. Tier. Woch.*, 1917. Oct. 11. Vol. 33. No. 41. p. 445. [Extracted from *Deut. Med. Woch.*, 1917. No. 35.]

HOFFMANN. The Prophylaxis of Foot-and-Mouth Disease.—(Abstract.) *Vet. Record*, 1917. Sept. 29. Vol. 30. No. 1525. p. 128.

HUTYRA (Franz) & MAREK (Josef). Orientalische Rinderpest mit besonderer Berücksichtigung der klinischen und anatomischen Merkmale und der Differentialdiagnose. [Eastern Rinderpest with Especial Reference to its Symptomatology, Morbid Anatomy, and Differential Diagnosis.]—With 15 coloured plates comprising 22 figs., and 3 text figs. 1916. Jena: Gustav Fischer. [Reviewed in *Schweiz. Archiv. Tierheilk.*, 1917. Oct. Vol. 59. No. 10. pp. 586–587.]

KOYANO (Tadayasu). Ueber das Verhalten der Blutkörperchen der experimentell (durch das fixe Virus) an Tollwut erkrankten Kaninchen. [The Behaviour of the Red Blood Corpuscles in Rabbits experimentally infected with Fixed Rabies Virus.]—*Mitteil. Mediz. Fak. Kaiserl.*, 1917. Mar. 12. Vol. 17. No. 1. pp. 69–84.

MORI (Nello). Sobre la naturaleza de los virus filtrables. [The Nature of Filterable Viruses.]—Extracted in *Rev. Hig. y Sanidad Pecuarias*, 1917. Oct. 1. Vol. 7. No. 7. pp. 358–379.

NICOLLE (Charles). De l'emploi du cobaye comme animal réactif pour le diagnostic experimental de la rage des rues. [The Use of the Guinea-Pig as a Test Animal for the Experimental Diagnosis of Street Rabies.]—*C. R. Soc. Biol.*, 1917. Oct. 20. Vol. 80. No. 16. pp. 788–789.

POWLEY (J. O.). Rats and Swine Fever.—*Vet. Record.*, 1917. Sept. 22. Vol. 30. No. 1524. p. 118.

PROESCHER (Frederick) & SEIL (Harvey A.). The Etiology of Hog Cholera (Second Report.)—*Jl. Amer. Vet. Med. Assoc.*, 1917. Aug. Vol. 51. (New Series. Vol. 4). No. 5. pp. 609–616. With 13 figs.

REMLINGER (P.). Comparaison de l'inoculation du virus rabique au lapin et au cobaye. [Comparison between the Effects of Inoculating Rabies Virus into the Rabbit and the Guinea-Pig.]—*C. R. Soc. Biol.*, 1917. July 28. Vol. 80. No. 15. pp. 670–672.

RÓNAI (Michael). Kutane Reaktion bei Schweinepest und Schweinediphtherie. [Cutaneous Reaction in Swine Fever and Swine Diphtheria.]—*Berlin. Tier. Woch.*, 1917. Aug. 23. Vol. 33. No. 34. p. 376. [Extracted from *Hússzemble* (Budapest), 1917. No. 6.]

SCHOSSBERGER (Alexander). Ein Fall von Maul-und Klauenseuche beim Menschen. [A Case of Foot-and-Mouth Disease in Man.]—*Berlin. Tier. Woch.* 1917. Aug. 2. Vol. 33. No. 31. p. 347. [Extracted from *Deut. Med. Woch.*, 1917. No. 26.]

VETERINARY RECORD, 1917. Sept. 8. Vol. 30. No. 1522. pp. 101–104. —Control of Swine Fever. [Extracted from Annual Report of Chief Veterinary Officer, Board of Agriculture and Fisheries, for 1916.]

VIALA (Jules). Les vaccinations antirabiques à l'Institut Pasteur en 1916. [Anti-Rabies Vaccinations at the Pasteur Institute for the Year 1916.]—*Ann. Inst. Pasteur*, 1917. July. Vol. 31. No. 7. pp. 368–372.

BACTERIAL DISEASES.

AXMANN (Johan). Diphtherie der Schweine. [Diphtheria in Swine.]—*Berlin. Tier. Woch.*, 1917. Aug. 23. Vol. 33. No. 34. p. 376. [Extracted from *Allatorvosi Lapok*, 1917. No. 24.]

BOZZELLI (Roberto). Studio sperimentale sulla Setticemia emorragica o Polmonite contagiosa delle capre. [An Experimental Study of Haemorrhagic Septicaemia or Contagious Pneumonia of Goats.] —*Ann. Staz. Sperim. per le Malat. Infet. d. Best.* 1916. Vol. 3. No. 2. pp. 105–135.

DAVIS (David John). Further Observations on Subcutaneous Abscesses in Rabbits. The Carrier State and its Relation to Rabbit Septicemia.—*Jl. Infect. Dis.*, 1917. Sept. Vol. 21. No. 3. pp. 314–321.

HALÁSZ (Franz). Abschwächen der Virulenz der Hühnercholerabakterien in Fröschen. [Attenuation of the Virulence of Fowl Cholera Organisms in Frogs.]—*Berlin. Tier. Woch.*, 1917. Oct. 4. Vol. 33. No. 40. p. 437. [Extracted from *Allatorvosi Lapok*, 1917. No. 32.]

KOEVES (J.). Rauschbrand- und Bradsot-ähnliche Krankheit der Schweine. [A Disease simulating Blackquarter and Bradsot in Swine.]—*Cent. f. Bakt.* 1. Abt. Orig., 1917. Aug. 30. Vol. 80. No. 1–3. pp. 40–65. With 5 plates.

LÓPEZ (C.). Acción del Cloruro Sòdico sobre el "Bacillus Anthracis" y Bacilos pseudo-carbuncosos. [Action of Sodium Chloride on the Anthrax Bacillus.]—*Treballs de la Societat de Biologia,* 1916. pp. 1–6.

LÓPEZ y LÓPEZ (C.) & ARMENDÁRITZ (J. G.). Prevención Anticarbuncosa en General. [Anti-Anthrax Immunisation.]—*Publicaciones de la "Revista de Higiene y Sanidad Pecuarias,"* 1917. 44 pp.

MORI (Nello). Studio sulla Setticemia emorragica osservata nelle pecore e negli ibridi muflone-pecora. [A Study of Haemorrhagic Septicaemia observed in Sheep and Cross-Bred Moufflon Sheep.]—*Ann. Staz. Sperim. per le Malat. Infet. d. Best.* 1916. Vol. 3. No. 2. pp. 3–35.

SCHMIEDHOFFER (Julius). Zur Ätiologie der Schweinediphtherie. [The Etiology of Swine Diphtheria.]—*Berlin. Tier. Woch.,* 1917. Aug. 23. Vol. 33. No. 34. p. 376. [Extracted from *Allatorvosi Lapok,* 1917. Nos. 25 & 26.]

MISCELLANEOUS.

ADAMI (Roberto). Alcuni casi di ematinuria nei bovini. [Some Cases of Haematuria in Bovines.]—*Clinica Vet.,* 1917. Oct. 31. Vol. 40. No. 20. pp. 611–616.

ALDIGÉ. Morsure par serpent venimeux. [Venomous Snake Bite.]—*Bull. Soc. Cent. Méd. Vét.,* 1917. July 5. *Rec. Méd. Vét.,* 1917. July 30. Vol. 92. No. 14. pp. 276–278.

——. Sur les anomalies de l'encornage des bovidés de l'Afrique occidentale française. [Anomalies in Horn Development of Bovines in French West Africa.]—*Bull. Soc. Cent. Méd. Vét.,* 1917. July 5. *Rec. Méd. Vét.,* 1917. July 30. Vol. 92. No. 14. pp. 278–284.

DALIMIER (R.). Le luargol (ou 102 de Danysz) en thérapeutique humaine. [Luargol (Danysz's 102) in Human Medicine.]—*Ann. Inst. Past.,* 1917. Oct. Vol. 31. No. 10. pp. 492–516.

DANYSZ (J.). Transformations des arsénobenzènes et leur action sur l'organisme (Deuxième mémoire). [Changes in the Arsenobenzenes and their Action on the Animal Body.]—*Ann. Inst. Past.,* 1917. Oct. Vol. 31. No. 10. pp. 483–491.

HIRSCHFELD. Zur makroskopischen Diagnose der Leukozytose und der Leukämie im Blute. Die makroskopische Oxydasereaktion. [Naked-Eye Diagnosis of Leucocytosis and Leukaemia in the Blood. The Naked-Eye Oxydase Reaction.]—*Berlin. Tier. Woch.,* 1917. Sept. 27. Vol. 33. No. 39. p. 426.

JOHNSTON (J. E. L.). On Some Peculiar Bodies found in the Blood of certain African Snakes.—*Jl. Trop. Med. & Hyg.,* 1917. Nov. 1. Vol. 20. No. 21. pp. 241–244. With 2 plates & 2 figs.

KALLÓS (Josef). Eine einfache neue Gallenfarbstoffreaktion. [A New Simple Bile Pigment Reaction.]—*Berlin. Tier. Woch.,* 1917. Aug. 2. Vol. 33. No. 31. p. 347. [Extracted from *Deut. Med. Woch.,* 1917. No. 24.]

LANGER (Hans). Nährböden aus Blut. [Blood Culture Media.]—*Berlin. Tier. Woch.,* 1917. Aug. 2. Vol. 33. No. 31. pp. 347. [Extracted from *Deut. Med. Woch.,* 1917. No. 23.]

MORI (Nello). i. Esistenza della Pleuropolmonite essudativa delle capre nell'Italia centrale e meriodionale. Nota preventiva. [Existence of Exudative Pleuro-pneumonia of Goats in Central and Southern Italy. Preliminary Note.] ii. Sulla etiologia della Pleuropolmonite essudativa delle capre. Reperto di particolari corpuscoli e isolamento di un ifomicete probabilmente specifico della malattia. [Etiology of Exudative Pleuro-pneumonia of Goats. Discovery of Peculiar Corpuscles and Isolation of a Probably Specific Hyphomycetes from the Disease.] iii. Sulla profilassi e sulla cura della Pleuropolmonite essudativa delle capre. [Prophylaxis and Treatment of Exudative Pleuro-pneumonia of Goats.]—*Ann. Staz. Sperim. per le Malat. Infet. d. Best.* 1916. Vol. 3. No. 2. pp. 39–78.

[The subject-matter of the above papers has already been extracted in this *Bulletin* (Vol. 4, No. 4, pp. 179-181, and Vol. 5, No. 1, pp. 55-56) from other journals.]

OSBORNE (Thomas B.) & MENDEL (Lafayette B.). The Food Value of Soy Bean Products.—*Procs. Soc. Experim. Biol. & Med.*, 1917. May 16. Vol. 14. No. 8. pp. 174–175.

PAINE (R.). Claviceps Paspali Poisoning in Cattle.—*Vet. Record*, 1917. Sept. 29. Vol. 30. No. 1525. p. 128.

PRESUTTI (Francesco). Studio epizooziologico, anatomo-patologico e clinico sulla Pleuropolmonite essudativa delle capre, manifestatasi nell'Alta Puglia. [The Epizootiology, Morbid Anatomy, and Symptomatology of Exudative Pleuro-pneumonia of Goats occurring in Alta Puglia, a District in South-Eastern Italy near Brindisi.]—*Ann. Staz. Sperim. per le Malat. Infet. d. Best.* 1916. Vol. 3. No. 2. pp. 81–101.

PRICE-JONES (Cecil). Blood Pictures: An Introduction to Clinical Haematology.—Bristol: John Wright and Sons, Ltd. Price 6*s*. 6*d*. net.

SCHELS. Vergiftungen bei Pferden nach Aufnahme von Akazienblättern. [Poisoning in Horses through Eating Acacia Leaves.]—*Berlin. Tier. Woch.*, 1917. Oct. 18. Vol. 33. No. 42. pp. 454–455.

VAUGHAN-KIRBY (F.). Game and Game Preservation in Zululand.—*S. African Jl. Sci.*, 1917. Apr. Vol. 13. No. 9. pp. 375–396.

VETERINARY RECORD, 1917. Sept. 1. Vol. 30. No. 1521. pp. 92–93.—Thirtieth Annual Administration Report of the Bombay Veterinary College for the Year 1915–1916. [Abridged.]

——, 1917. Sept. 1. Vol. 30. No. 1521. pp. 93–95.—Annual Administration Report of the Civil Veterinary Department, Bombay Presidency, for the Year 1915–1916. [Abridged.]

——, 1917. Nov. 3. Vol. 30. No. 1530. p. 183—The Lupines as Poisonous Plants.

INDEX OF AUTHORS OF PAPERS ABSTRACTED.

A.

Aguzzı, A., *see* Cosco & Aguzzi
Akatsu, S., & Noguchi, H., 94
Aubry, —, 37

B.

Bayon, H., 26
Béguet, —, 56
Bedensky, P., 7
Bequaert, J., *see* Rodhain & Bequaert
Bilhaut, —, 41
Blanc, G., 165
Blanchard, R., 143
Boerner, F., Junr., *see* Hardenbergh & Boerner
Bonnel, —, *see* Fayet & Bonnel
Boquet, A., & L. Négre, 116
Bouet, G., 15
—— & Roubaud, G., 78, 112, *see also* Roubaud & Bouet
Bouilliez, M., 88, 89
Boynton, W. H., 48
Brandt, F. R., 67
Bridré, —, 41, 42
Bringard, —, 185
Brocq-Rousseu, —, 41
Brogan, G. H., 266
Brohier, S. L., 59, 60
Bruce, E. A., *see* Hadwen & Bruce
Brug., S. L., 6
Bruggeman, J. P. I., 229
Burton, A. C., 206

C.

Campus, A., *see* Finzi & Campus
Camus, L.. 53, 54
Chambers, F., 222
Carpano, M., 144
Cartier, J., 38
Castellani, A., 24
Cazalbou, L., & G. Morel, 41, 42
Chapin, R. M., 57
Chapron, H., 39
Charmoy, —, 184
Chenièr, —, 40, 41, 42
Cleland, J. B., S. Dodd, & E. W. Ferguson, 107
Coghill, H. S., *see* Connal & Coghill
Connal, A., & H. S. Coghill, 69
Conreur, C., & G. Urbain, 252
Cosco, G., & A. Aguzzi, 197
Cross, H. E., 71, 211

D.

Davis, D. J., 43
de Jong, D. A., 200
d'Hérelle, F., 55
Dickinson, C. G., & G. F. Hill, 250
Dodd, S., *see* Cleland, Dodd & Ferguson
Doeve, W. C. A., 223
Dold, H., 45
Dykins, W. A., & R. P. Jones, 156

E.

Eichhorn, A., 204
—— & Gallagher, B., 2

F.

Favero, F., 186
Fayet, —, & Bonnel, 41, 81
Ferguson, E. W., *see* Cleland, Dodd & Ferguson
Fermi, C., 195
Ferraro, G., 253
Finzi, G., 185
—— & Campus, A., 3
Fletcher, T. B., 111
França, C., 231

G.

Gaiger, S. H., 273
Gallagher, B., 48, *see also* Eichhorn & Gallagher
Garden, G., 79
Gauducheau, A., 132
Gibbs, H. E., & G. G. Pook, 208
Gillespie, A., *see* Gregg, J., & others
Gins, H. A., 196
—— & Weber, R., 197
Glaeser, H., 30
Glover, G., *see* Gregg, J., & others
Gray, C. E., 291
Gregg, J., 203
——, Maguire, F. X., G. T. Glover, A. Gillespie, & G. Gregory, 203
Greggio, G., 97
Gregory, G., *see* Gregg, J., & others
Guillebeau, A., 5

H.

Hadley, P. B., 87
Hadwen, S., 267
—— & Bruce, E. A., 109

Hardenbergh, J. B., & F. Boerner, jnr., 189, 254
Harris, W., 283
Havet, J., *see* Laveran & Havet
Hempl, H., *see* Sergent & Hempl
Higgins, C. H., 88
Hill, G. F., *see* Dickinson & Hill
Hornby, H. E., 148
Hutchins, E., 75

J.

Jack, R. W., 112, 221
Jacoulet, —, 42
Johnson, P. E., 205
Jones, R. P., *see* Dykins & Jones

K.

Kallert, E., 47
Kolmer, J. A., F. J. Schamberg, & G. D. Raiziss, 98
Kolmer, W., & R. J. Wagner, 95
Konradi, D., 118
Koselkine, D. M., *see* Yakimoff, Schokhor, Koselkine & Paroisky

L.

Laveran, A., 8, 12, 90, 142
—— & Havet, J., 141
Le Gallen, R., *see* Leger & Le Gallen
Leger, A., 106, 144
—— & Le Gallen, R., 142
Leger, M., 103
—— & Mouzels, P., 91, 104, 165
Low, G. C., 24

M.

Macfie, J. W. S., 1, 18, 20, 25, 58, 92, 225, 280
Martel, H., 197
Martoglio, F., 195
Mason, F. E., 117
Maynard, G. D., 150
Miessner, H., *see* Nevermann, Miessner, & Weichel
Meyer, K. F., 44
Miller, J. D., 291
Milne, A. S., 211
Mitzmain, M. B., 10
Mohler, J. R., 190
Montgomery, E., 128
Montgomery, R. E., 63, 290
Morel, G., *see* Cazalbou & Morel
Mori, N., 55, 191, 204
Morstatt, H., 29
Mouzels, P., *see* Leger & Mouzels

N.

Négre, L., *see* Boquet & Négre
Nevermann, L., H. Miessner, & A. Weichel, 260
Nicolas, E., 39, *see also* van Saceghem & Nicolas
Noeller, —, 15, 28, 166
Noguchi, H., *see* Akatsu & Noguchi

O.

O'Dea, M. E., 291
Offermann, —, 19
Olver, —, 41, 42

P.

Panisset, L., 206
Paroisky, P. L., *see* Yakimoff, Schokhor, Koselkine, & Paroisky
Petit, A., 40, 42
Piettre, —, 36
Piot, J. B., 111
Pook, G. G., *see* Gibbs & Pook
Pricolo, A., 230

Q.

Quinlan, D., 284

R.

Raiziss, G. D., *see* Kolmer, Schamberg, & Raiziss
Remlinger, P., 192, 193
Rieckenberg, H., 99
Ritz, H., 100
Robertson, M., 113
Rodhain, J., & J. Bequaert, 110
Roig, G., *see* Sergent & Roig
Roubaud, E., 27, 174
—— & van Saceghem, 28, *see also* Bouet & Roubaud

S.

Sani, L., 194
Saphronowitsch, R. A., *see* Yakimoff & Saphronowitsch
Schamberg, J. F., *see* Kolmer, Schamberg, & Raiziss
Schokhor, N. J., *see* Yakimoff, Schokhor, & others
Schuscha, A. T., 101
Seddon, H. R., *see* Sweet & Seddon
Sergent, E., & H. Hempl, 164
—— & G. Roig, 209
Shilston, A. W., 66, 120
Sinclair, J. M., 212
Smillie, E. W., *see* Smith & Smillie
Smith, T., 86
—— & Smillie, E. W., 85
Société de Pathologie Comparée, 40
Soetedjo, R., *see* Sohns & Soetedjo
Sohns, J. C. F., & R. Soetedjo, 257
Sparapani, —, 90
Stelko, W., 231
Stordy, R. J., 61, 285
Stoute, R. A., 148
Sturgess, G. W., 212
Sweet, G., & H. R. Seddon, 177
Swe y, O., 102

T.

Tabusso, M. E., 269
Teichmann, E., 152
Trawinski, A. 188
Truche, C., 187

U.

Urbain, G., *see* Conreur & Urbain

V.

van Saceghem, R., 46, 90, 108, 133, 248
—— & Nicolas, E., 21, *see also* Roubaud & van Saceghem
Veglia, F., 30
Velu, H., 36, 42. 56, 96, 114, 186, 210
von Ostertag, R., 122

W.

Wagner, R. J., *see* Kolmer & Wagner
Wassilevsky, W. J., *see* Yakimoff & Wassilevsky
Watkins-Pitchford, H., 277
Watson, E. A., 255
Weber, R., *see* Gins & Weber
Wehrbein, H., 155
Weichel, A., *see* Nevermann, Miessner & Weichel
Wirth, D., 237

Y.

Yakimoff, W. L., 105, 165, 176
—— & Collaborators, 105, 145
—— & Saphronowitsch, R. A., 104
—— & Schokhor, N. J , 105, 164
—— & Wassilevsky, W. J., 154

Z.

Zonchello, A., 127

SUBJECT INDEX.

Compiled by Miss M. H. James.

Abortion
CONTAGIOUS in
Cattle
Diagnosis, 65
Economics, 289
Incidence
British East Africa, 65, 289
Europe, 289
Rhodesia, Southern, 213
Union of South Africa, 293
Prophylaxis, 289
Treatment, 213
Equines: India; Causal Agent, 67

Acariasis
Psoroptic Otacariasis, of Sheep and Rabbits; Belgian Congo. 29
Sarcoptic Mange of Pigs and Goats, Transmissible to Man, 27-8
Symbiotic Mange of Horses: Belgian Congo, 29

Acne, Contagious, of Horses: Germany, 201

Agalaxy, Contagious, of Goats; Algeria, 209-10

Ai, or Three-toed Sloth, *Microfilaria kerandeli* from; French Guiana, 91-2

Amakebe, *see under* **Theileriasis**

Amoebiasis (AMOEBIC DYSENTERY, *and* LIVER-ABSCESS), 1-3, 85-6; *see also* **Blackhead in Turkeys**
Amoebae and Entamoebae associated with
Pathogenic, 27
A. ateles, in Monkeys: U.S.A., 3
A. histolytica, in Monkeys: U.S.A., 3
Infection: Cats Susceptible to, 3
A. meleagridis, of Blackhead in Turkeys, considered as Developmental Stage of
Eimeria avium, 85
Trichomonas, 88
E. cercopitheci, in Monkey: Accra, 1

Amoebiasis—*cont.*
Animals affected by
Cats, 3
Monkeys, 1, 2
Symptoms, 3
Transmission Experiments, 3

LIVER ABSCESS, in Monkeys: U.S.A., 2-3

Recent Literature, 17, 134, 135
Treatment by Emetine, 101, 102

Anaemia
EXPERIMENTAL, in Rabbits and Sheep, 4-5

INFECTIOUS, or Swamp Fever, in Equines
British East Africa, 64
Dutch E. Indies, 257-60
U.S.A., 191
Diagnosis by
Inoculation, 259
"Sinking and other Tests" with Blood, 259
Diagnostic Difficulties, 191
Prophylaxis, 259-60
Symptoms, 257, 258, 259
Transmission, 258
Treatment by
Sod. Citrate, 259
Sod. Taurocholate, 259

PERNICIOUS, in Dogs, due to *Ankylostoma tubaeforme*, 255

Anaphylaxis, Experimental, in Cattle and Sheep induced by Larvae of *Hypoderma bovis, H. lineatum*, and *Oestris ovis*, 109-10

Anaplasmosis, 3-5, 229-31
BOVINE, in
Buffaloes: Java; Symptoms, 229-30
Bodies found in Blood-Corpuscles, 229-30
Cattle, or Gall-Sickness
Incidence
British East Africa, 65
Russian Turkestan
with Nuttalliasis, 148
with Theileriasis, 147

Anaplasmosis—*cont.*
Bovine, in—*cont.*
Cattle—*cont.*
Incidence—*cont.*
South Africa, 5, 65
Turkey, 231
Uganda, 65
Intra-Corpuscular Bodies in, 3
Theileria mutans in relation to, 236

Canine: Russian Turkestan; with Leishmaniasis, 148

Differentiation of, from other forms of Anaemia, and Redwater, 5
Elimination of, from Rinderpest Producers, 125

Equine: Russian Turkestan; Complications, 148

Ovine: [Suspected, in Piedmontese and Sardinian Sheep; Experiments, 3–5
Parasites Associated with
Anaplasma
Morphology and Incidence, 3
in Rodents. Transcaucasus, 104
A. centrale, in Bovines, 148, 230, 231
A. marginale, in
Bovines, 125, 148, 230
Rodents, 144

Aneurisms, in Buffaloes, due to Onchocerca Invasion, 172

Ankylostomiasis, *see under* **Helminthias**

Anteater, Ectoparasite of, Transmissible to Man, 27 *& n.*

Antelopes
Diseases of
Theileriasis
Incidence
Abyssinia, 236
Africa, 236
Gambia, 281
Portugal, 236
Parasites of
Oestrine larvae:
Africa, 110
Belgian Congo, 174
Theileria
T. dama: Portugal, 236
T. hippotragi
Africa, 236
Gambia, 281
T. mutans-type: Accra, 281
T. stordii: Abyssinia, 236
Trypanosomes, Polymorphic: Accra, 281

Anthrax
in Animals other than Bovines:
Assam, 283
Bovine
Bacillus of; Variable Susceptibility to, 288
Development of, after Double Inoculation for Rinderpest, 288
Economics, 293
Incidence
Assam, 283, 284
British East Africa, 62, 288
British Guiana, 211
Gold Coast, 291
India, 75, 285
Nigeria, 69
Trinidad, 291
Union of South Africa, 293
Venezuela, 291

in Camels: India, 75

Equine
Incidence
Assam, 283, 284
Trinidad, 291

Immunising effect of Dead Vaccines, 67

Ovine, in
Ceylon (imported), 212
India, 212
Prophylaxis
Inoculation, 211, 285, 293
Recent Literature, 82
Transmission, 288
Treatment by Serotherapy and Vaccine, 62, 67, 68, 283, 284

Asses
Diseases of
Bone-affecting: U.S. Africa, 294
Nuttalliasis, in
Russian Turkestan, 147
Transcaucasia, 147
Spiroptera Infection: British East Africa, 63
Insects Injurious to: Zanzibar, 179
Parasites of
Filaria and Microfilaria
M. ninae-kolhyakimovi: Russian Turkestan, 105

Auricular Psoroptic Mange, *see under* **Mange**

Avian Diseases, *see under* **Birds, Malaria, Spirochaetosis**, *&c.*

Babesiasis, *see under* **Piroplasmosis**

Bacterial Diseases, 45–6, 117–18, 187–91, 254–6; *see also* **Anthrax; Blackquarter; Cellulitis, Ulcerative; Colon Bacillosis; Dermatitis; Dysentery; Lymphangitis, Ulcerative; Septicaemia, Haemorrhagic; Tuberculosis**
Cutaneous, of Equines, due to Preiz-Nocard Bacillus: B.E. Africa, Vaccine Treatment, 108
Recent Literature, 82, 139, 218–19, 302–3

Bacteriology
Bacteria of Typho-coli Group in Healthy Pigs, 188
Differentiation of the Bacteria of the Small Paratyphoid B. group, 188–9
Dermatophilus congolensis; Cause of Tropical Dermatitis in Bovines, 109
Rickettsia
R. melophagi, of Sheep Louse, 168
R. prowazeki, of Clothes Louse, 168

Barbone, or Buffalo Plague: Italy, *see* **Septicaemia, Haemorrhagic**

Bats, *Achromaticus* sp. in, 236

Birds, *see also* Canaries; Crows; Ducks; Fowls; Herons; Owls; Quail; Snipe; Sparrows; Turkey; Whitethroat, &c.
Diseases of
Malaria, 6, 164
Myiasis: Belgian Congo, 28–9
Spirochaetosis: Senegal, 142–3
Insects infesting
Belgian Congo, 28, 29
British Guiana, 182
Parasites of
Haemoproteus, 234
H. danilewski: Accra, 281
Leucocytozoa
L. anatis, in Duck: Canada, 234
L. berestneffi, in Magpies: France, 103
L. sicmanni, in Owls: France, 104
Unnamed, in Crows: France, 103
Microfilariae (unnamed) in: Senegal, 106–7

Blackhead, in Turkeys, formerly Identified with Amoebiasis, 85–9
Incidence
America, U.S., 85–8
Canada, 88
Parasites associated with
Amoeba meleagridis, Experiment to ascertain if a Stage of *Eimeria avium*, 85
Trichomonas
Amoeba meleagridis in relation to, 88
Mode of Penetration of: Goblet cells in relation to, 87-8
Prophylaxis, 89
Biological Method of Raising Turkeys, in relation to, 88–9
Transmission Problems, 85, 86, 88
Treatment, 88

Blackquarter, or Quarter-Evil
Animals affected by
Bovines, 62, 65, 69, 213, 283, 285, 290
Camels (Experimental), 73
Other than Bovines, 283
Incidence: All Animals
Assam, 283
British East Africa, 62, 65
India, 73, 285
Nigeria, 69
Rhodesia, Southern, 213
Prophylaxis, 285
Treatment by Vaccine, 68

Blue-Tongue, in Sheep, Union of South Africa, 294
Seasonal Incidence, 293, 294

Bone-Disease, in Donkeys: Union of South Africa, 294

Book Reviews, *see* **Reviews of Books**

Bovines (Buffaloes, Carabao, Cattle, Zebus, &c.)
Diseases of
Abortion, Contagious
Incidence
British East Africa, 65, 289
Europe, 289
Rhodesia, Southern, 213
Union of South Africa, 293
Amakebe, *see under* Theileriasis
Anaplasmosis
Incidence
British East Africa, 65
Java, 229–30
Russian Turkestan, 147–8
South Africa, 65
Turkey, 231
Uganda, 65

Bovines—*cont.*
Diseases of—*cont.*
Anaplasmosis—*cont.*
Nuttalliasis as Complication, 148
Theileriasis as Complication, 147
Gall-Sickness
Differentiation from Red-Water, &c., 5
Incidence
Africa, 236
South Africa, 3, 5
Union of South Africa, 293
Anthrax
Incidence
Assam, 283, 284
British East Africa, 62, 288
British Guiana, 211
Gold Coast, 291
India, 75, 285
Nigeria, 69
Trinidad, 291
Union of South Africa, 293
Venezuela, 291
Babesiasis
Incidence
Accra, 59
Nigeria, 69
Blackquarter
Incidence
Assam, 283
British East Africa, 62, 65, 290
India, 285
Rhodesia, Southern, 213
C.H.: British East Africa, 66
Colon Bacillosis: B.E. Africa, 65
Cow-pox
Incidence
Germany, 196–7
Holland, 201
Dermatitis, Tropical, 108–9, 133
East Coast Fever
Incidence
Belgian Congo (suspected), 90–1
B.E. Africa, 61, 65, 286–8
Southern Rhodesia, 212–13
South Africa, 230
Union of South Africa, 238, 291
Ephemeral Fever: U.S. Africa, 293
Ferrujâo: Portugal, 235
Foot-and-Mouth, 47–8, 197–200
Complication, 197
Disease Resembling, 205, 206
Incidence
Argentina, 271
Assam, 283, 284
British East Africa, 289
Ceylon, 212
France, 197
India, 285
Nigeria, 69
Peru, 271
Uganda, 76, 289

Bovines—*cont.*
Diseases of—*cont.*
Haematuria, 267–9
Incidence
Age, 268
Geographical
Australia, 269
Canada, 267, 269
Hawaii, 269
Locale, 268, 269
Season, 267
Gall-Sickness, *see under* Anaplasmosis, *supra*
Lamziekte or Gal-lamziekte, 293
Mange, Demodectic, 108–9
Incidence
Belgian Congo, 109
Europe, 109
Nyasaland, 109
South America, 109
Mediterranean Coast Fever, 236
Myiases: Belgian Congo, 28, 173-4
Myocarditis, with Foot-and-Mouth Disease: France, 197
Onchocerciasis or Worm Nodule
Incidence
Australia
New South Wales, 107
Northern Territory, 250-2
South America, 36
Aortic: Senegal, 171–2
Ophthalmia, Infectious: Ceylon, 212
Pataleta: Argentina, 270
Piroplasmosis
Incidence
Africa, 235
America, 235
Asia, 235
Australia, 235
British East Africa, 64, 65
Egypt, 111
Europe, 235
Great Britain, 235 *n.*
Italy, 231, 235
Nigeria, 69, 71
Portugal, 235
Rhodesia, 236
Roumania, 235
Russia, 235
Pleuro Pneumonia, Contagious
Incidence
Barotseland, 266–7
British East Africa, 289
Nigeria, 69
Portuguese West Africa, 266
Union of South Africa, 293
Quarter Evil, *see* Blackquarter
Red Dysentery, or Bovine Intestinal Coccidiosis: Italy, 163
Redwater, *see* Piroplasmosis, *supra*
Rinderpest, 48-52, 120–8, 195–6
Incidence
Abyssinia, 127

Bovines—*cont.*
  Diseases of—*cont.*
    Rinderpest—*cont.*
      Incidence—*cont.*
        Asia Minor, 264, 266
        Assam, 283, 284
        British East Africa, 62, 64, 65, 76, 127, 288
        Bulgaria, 260, 264
        Ceylon, 212
        Eritrea, 127–8, 195–6
        German East Africa, 122 *et sqq.*
        Gold Coast, 291
        India, 67, 285
        Indo-China, 49
        Nigeria, 67–8
        Philippines, 48 *et sqq.*, 126
        Somaliland, 127
        Sumatra, 49
        Turkey, 260, 263–6
        Uganda, 75–6
    Septicaemia, Haemorrhagic
      Incidence
        Assam, 283, 284
        India, 73, 285
        Italy, 191–2
        U.S.A., 189–90
    Stomatitis, Contagious Pustular: U.S.A., 204 *et sqq.*
    Theileriasis, *see also* East Coast Fever, *&* Mediterranean Coast Fever, *supra*
      Incidence
        Russian Turkestan, 147
        Uganda, 236
        Various Lands, 236
      Various Forms, 236
    Trypanosomiases
      Incidence, All Forms
        Accra, 18, 59
        Africa, 11, 236
        Belgian Congo, 21, 23
        British East Africa, 289
        British Guiana, 212
        Eritrea, 253
        French West Africa, 16, 172
        India, 11
        Mauritius, 12
        Nigeria, 70, 71
        Rhodesia
          Northern, 222–3
          Southern, 221–2
        Sebungwe, 113
        Uganda, 76
        Union of South Africa, 293
        Zanzibar, 179
      Sesheke: Northern Rhodesia, 22
      Surra
        Incidence
          India, 11
          Mauritius, 12
    Tuberculosis
      Incidence
        Egypt, 117

Bovines—*cont.*
  Diseases of—*cont.*
    Tuberculosis—*cont.*
      Incidence—*cont.*
        Rhodesia, Southern, 213
        Union of South Africa, 292–3
    Tumours, Warty, in Zebu: Zambi, 133
  Insects Infesting (*see also Dermatophilus*, Ticks, &c., *under* **Entomology**), in
    America, 109
    Belgian Congo, 29, 108, 109
    British Guiana, 180–1
    Nyasaland, 109
    Philippines, 13
    Zanzibar, 198 *et sqq.*
  Parasites of
    Filaria: R. Turkestan, 106
    Piroplasms, 230–1
      P. bovis (*bigeminum*), 231, 235
      P. divergens, 235
      P. unnamed: Accra, 281
    Theileria, 236
    Trypanosoma
      T. pecorum, 11
      T. theileri, 293
    Wireworm: B.E. Africa, 63

Buffaloes, *see also* **Bovines**, *supra*
  Diseases of
    Anaplasmosis: Java, 229–30
    "Barbone," or Buffalo Plague, with Symptoms of Intoxication; Italy, 191–2
    C.H.: British East Africa, 66
    Onchocerciasis: Senegal; Aneurisms caused by, 172
    Plague, *see* Barbone, *supra*
    Rabies: Italy, 191–2
    Rinderpest: Uganda, 76
    Septicaemia, Haemorrhagic: *see* Barbone, *supra*, 191–2
    Surra: Dutch East Indies, 223–5, 229
  Insects Infesting
    Belgian Congo, 29
    Zanzibar, 178
  Indian, in British Guiana, Ectoparasite of, 181
  Swamp; Free from Onchocerciasis: Australia, 252

Bush Pig (*see also* **Swine**), Rinderpest in: Uganda, 76

Caenurosis, *see under* **Helminthiasis**

Camels and Dromedaries
  Anti-fly Emulsion Experiments on 72–3
  Diseases of
    Anthrax: India, 75

Camels and Dromedaries—*cont.*
Diseases of—*cont.*
Blackquarter, Experimental: India, 73
Jhooling, or Jhoolak: Punjab, 73–4
Rheumatism, Articular, 74
Septicaemia, Haemorrhagic, 73
Sore Throat: Punjab, 73
Surra, *see under* Trypanosomiases, *infra*
Theileriasis: Russian Turkestan, 147
Trypanosomiases
Incidence
Eritrea, 253, 257
Tripoli, 253
Surra: Punjab, 72, 74–5
Tuberculosis
Incidence
Algeria, 117
Egypt, 117–18
India, 117
Sudan, 117
Wail: Punjab, 74
Feeding Experiments as to Green Food and Water, 73
Parasites of
Microfilaria, 106
Oestrinae peculiar to, 110
Purgatives for, and Dosage with, 211
Report on, of Specialist, *see under* **Reports**
Ticks of: Zanzibar, 179–80

Canaries
Parasites of
Proteosoma
Pigmentless, 163
P. praecox, 6, 163–4

Canine Diseases, *see under* Names, *& under* Dogs, Jackals, *and* Wolves

Carabao
Diseases of: Philippines
Rinderpest, 49
Surra, 12

Cats
Diseases of
Amoebiasis, 3
Kiolo, or Cutaneous Myiasis: Belgian Congo, 173
Parasites of
Physaloptera ? preputialis: British Guiana, 180
Spirochaetes and Treponema
S. canis, n. sp.: Accra, 94
S. eurygyrata-type: Accra, 94
S. regaudi, 96

Cattle
Diseases of
Abortion, Contagious
Incidence
British East Africa, 65, 289
Europe, 289
Rhodesia, Souther, 213
Union of South Africa, 293
Amakebe, *see under* **Theileriasis**
Anaplasmosis
Incidence
British East Africa, 65
Russian Turkestan, 147, 148
South Africa, 3, 65, 236
Turkey, 231
Uganda, 63
Union of South Africa, 293
Babesiasis, *see* Piroplasmosis, *infra*
Blackquarter
Incidence
Assam, 283
British East Africa, 62, 65, 290
India, 285
Rhodesia, Southern, 213
C.H.: British East Africa, 66
Coccidiosis, Italy, 163
Colon Bacillosis: Africa, 65
Cow-pox or Vaccinia
Incidence
Germany, 196–7
Holland, 201
East Coast Fever, 123
Incidence
Belgian Congo (Suspected), 90–1
B.E. Africa, 61, 65, 286–8
Rhodesia, Southern, 212–13
South Africa, 230
Union of South Africa, 291–2
Ephemeral Fever: Union of South Africa, 293
Ferrujão: Portugal, 235
Foot and Mouth, 47–81, 197–200
Incidence
Argentina, 271
Assam, 283, 284
British East Africa, 289
Ceylon (Marked Decrease), 212
France, 197
India, 285
Nigeria, 69
Peru, 271
Uganda, 76, 289
Gall-Sickness, *see* Anaplasmosis
Haematuria
Incidence, 267–9
Age, 268
Geographical
Australia, 269
Canada, 267, 269
Hawaii, 269
Locale, 268, 269
Season, 267
Lamziekte, 293

Cattle—*cont.*
Diseases of—*cont.*
Mange. Demodectic
Incidence
Belgian Congo, 109
Europe, 109
Nyasaland, 109
South America, 109
Myiasis : Belgian Congo, 28
Cutaneous: Belgian Congo, 173–4
Myocarditis, with Foot and Mouth Disease : France, 197
Onchocerciasis or Worm Nodule
Incidence
Australia, 107, 250–2
South America, 36
Aortic ; Senegal, 171–2
Ophthalmia, Infectious : Ceylon, 212
Palaleta : Argentina, 270
Piroplasmosis
Incidence
Accra, 59
Africa, 235
America, 235
Asia, 235
Australia, 235
British East Africa, 65
Egypt, 111
Europe, 235
Great Britain, 235*n*
Italy, 231, 235
Nigeria, 69, 71
Portugal, 235
Rhodesia, 236
Roumania, 235
Russia, 235
Russian Turkestan, 145–6
Sardinia, 235
Siberia, 235
Tunis, 230–1
Transcaucasia, 235
Turkey, 231
Pleuro-Pneumonia, Contagious
Incidence
Barotseland, 266–7
British East Africa, 62, 289
Nigeria, 69
Portuguese West Africa, 266
Union of South Africa, 293
Quarter-Evil, *see* Blackquarter, *supra*
Red Dysentery, or Bovine Intestinal Coccidiosis : Italy, 163
Redwater, *see* Piroplasmosis, *supra*
Rinderpest, 48–52, 120–8, 195–6
Incidence
Abyssinia, 127
Asia Minor, 264, 266
Assam, 283, 284
British East Africa, 62, 64, 65, 76, 127, 288
Bulgaria, 260, 264
Ceylon, 212

Cattle—*cont.*
Diseases of—*cont.*
Rinderpest—*cont.*
Incidence—*cont.*
Eritrea, 127–8, 195–6
German E. Africa, 122 *et sqq.*
Gold Coast, 291
India, 67, 285
Indo-China, 49
Nigeria, 67–9
Philippines, 49
Somaliland, 127
Sumatra, 49
Turkey, 260, 263–6
Uganda, 75–6
Septicaemia, Haemorrhagic
Incidence
Assam, 283, 284
India, 73, 285
U.S.A., 189–90
Sesheke, *see under* Trypanosomiasis, *infra*
Stomatitis, Contagious Pustular : U.S.A., 204 *et sqq.*
Theileriasis, *see also* East Coast Fever, *supra*
Incidence
Russian Turkestan, 147
Uganda, 236
Various Lands, 236
Trypanosomiases
Sesheke : N. Rhodesia, 222
Surra
Incidence
India, 11
Mauritius, 12
Trypanosomiasis, 15
Incidence
Accra, 18, 59
Africa, 11, 236
Belgian Congo, 21
British East Africa, 289
British Guiana (imported), 212
French West Africa, 16, 17
Nigeria, 70
Rhodesia and adjoining lands, 148–50
Sebungwe, 113
South Africa, 293
Uganda, 76
Union of South Africa, 293
Tuberculosis
Incidence
Egypt, 117
Southern Rhodesia, 213
U.S.A., 292–3
Vaccinia, generalised, in Calf, 53
Fouta Djalon Breed, Trypanosomiasis-resistant, 16
Immunisation of, against Diseases : B.E. Africa, 65
Insects Infesting, *see also under* Entomology
America, 109

Cattle—*cont.*
Insects Infesting—*cont.*
Australia, 107–8
Belgian Congo, 29, 109
British Guiana, 180–1
Nyasaland, 109
Philippines, 13
Zanzibar, 178 *et sqq.*
Parasites of
Piroplasma, 230–1, 235, 281
Spirochaetes
S. eurygyrata-type : Accra, 93, 94
Theileria
T. mutans, 236
Trypanosoma
T. theileri, 169, 293
Wireworm : B.E. Africa, 63

Cellulitis, Ulcerative, Equine, or Ulcerative Lymphangitis: France, 255–6
Treatment
Local, 256
Vaccine, 255–6

C.H. Disease, in Cattle: British East Africa, 66

Chameleon pumilis
Parasites of
Herpetomonads: Robben Island, 27

Chemotherapy
Chemical Composition of Lime Sulphur Dips, 57
Drug-fastness of Spirochaetes, to Arsenic, &c., *in vitro*, 94–5
Luargol, in Treatment of Experimental Dourine in Mice, 154
Purgatives, Action of, on Camels, 211
Tartar Emetic; History of Use of, Intravenously, 24
Thymol as Specific, in Bovine Intestinal Coccidiosis, 163
Toxicity of Drugs given for Trypanosomiasis, 156
Trypanocidal action of Sodium Protosonate, 212

Coccidiosis, 5–6
AVIAN, in Sparrows, in relation to Blackhead in Turkeys, 85–6
Parasites
Coccidia
Description of, 85
Genus of, 86

BOVINE Intestinal, or Red Dysentery: Italy; Causal Agent: Cure, 163

Coccidiosis—*cont.*
HEPATIC, in
Dogs, 5–6
Rabbits, 5
Parasites associated with
Coccidium bovis, 162
Diplospora, 86
D. bigeminum, 5
Eimeria
E. stiedae, 5
E. zurni, 163
Isospora, 86

Recent Literature, 298

Colon Bacillosis, in Cattle: British East Africa, 65
Vaccine for, 65

Cow-pox, Jenner's, or **Vaccinia**
Immunisation Experiments, 196–7
Incidence
Germany, 196–7
Holland, 201
Relation of, to Equine Pustular Contagious Stomatitis, 200 *et sqq.*
Treatment by Vaccine, 196, 197
Virus, injected into Blood Stream, in Rabbits, Fate of, 197

Crocodiles
Parasites of
Haemogregarina
Accra, 60
Nigeria, 71

Crows
Parasite of
Leucocytozoon: France, 103

Cutaneous Disease of Equines, due to Preiz-Nocard Bacillus: B.E. Africa: Vaccine Treatment, 188

Demodectic Mange, *see under* **Mange**

Dermatitis
GRANULAR, Equine, *see under* **Helminthiasis,** *infra*

TROPICAL Bovine
Causal Agent, 108, 109
Differentiation of, from Demodectic Mange, 108–9
Papillomata in, 133
Symptoms and Complications, 109, 133
Treatment by Carbolic Vaseline Ointment, 109

ULCERATIVE, Equine: Belgian Congo, 46
Causal Agent, 46
Lesions, Locale of, 46

Diseases due to Filterable or Ultra-Visible Viruses, 47–54, 118–32, 191–200, 257–67; *see* **Anaemia, Equine, Infectious; Foot and Mouth Disease; Fowl Pox; Nairobi Sheep Disease; Pleuro-Pneumonia, Bovine, Contagious; Rabies; Rinderpest; Sheep-Pox; Stomatitis, Contagious Pustular; Variolae**
Equine Influenza probably one, 254
Recent Literature, 81–2, 138, 217-18, 301-2

Distemper, in Dogs: Assam, 283

Dogs
Diseases of
Anaemia, Pernicious, due to *Ankylostoma tubaeforme*, 253
Anaplasmosis: Russian Turkestan; Complications, 148
Ankylostomiasis
Incidence
Accra, 281–2
Brazil, 252
Sierra Leone, 281
Babesiasis, *see* Piroplasmosis, *infra*
Bacillary Dysentery: Accra, 45–6
Coccidiosis, Hepatic, 5–6
Distemper: Assam, 283
Enteritis, Haemorrhagic, due to Uncinariasis (Ankylostomiasis): Brazil, 252
Filariasis
Incidence
British Guiana, 180
Russian Turkestan, 106
Gastro-Enteritis, Epizootic: Germany, 253
Leishmaniasis, 294–6
Experimental, 141
with Anaplasmosis: Russian Turkestan, 148
Mixed Infection with Anaplasmosis and Leishmaniasis: Russian Turkestan, 148
Myiasis
Incidence
Belgian Congo, 173
Ceylon, 212
Oral: Ceylon, due to *Pycnosoma flaviceps*, 212
Nambiuvù: Brazil, due to *Rangelia vitalli*, 236
Piroplasmosis
Incidence
Accra, due to *P. canis*, 281
Nigeria, 69

Dogs—*cont.*
Diseases of—*cont.*
Rabies
Incidence
Assam, 283
B.E. Africa (suspected), 290
Ceylon, 212
India, 195
Italy, 195
Renguera, in Sheep-Dogs: Peru, 271
Taeniasis, with Intussusception: Accra, 281
Toxoplasmosis
Incidence
Brazil, 237
Germany, 237
Italy, 237
Tunis, 165
Trypanosomiasis
Incidence
Accra, 60, 281
French West Africa, 17
Nigeria, 70, 71
Vaccinia, Generalised, 53
Insects Injurious to
British Guiana, 180
Zanzibar, 179, 180
Parasites of
Achromaticus gibsoni: Madras, 236
Ankylostoma
A. caninum, in
Lagos, 282
Sierra Leone, 281
A. ceylanicum in
Accra, 281–2
Sierra Leone, 281
One resembling: British Guiana, 180
Ascaris: Accra, 282
Filaria and Microfilaria
Embryos: Accra, 281
F. immitis, 247
British Guiana, 181
Mf. immitis, one like: Russian Turkestan, 106
Grahamella: Accra, 60
Helminths: British Guiana, 91, 180
Leishmania tropica, Pathogenicity of; Experiments on, 89
Leucocytogregarina
L. canis: Russian Turkestan, 164–5
Piroplasma
P. canis, 235
Plasmodia
P. canis, 234
Rangelia vitalli: Brazil, 236
Rossiella rossi, in *Canis adustus*: Africa, 236
Spirochaetes and Treponema in Experimental Trypanosomiasis: Sudan, 94

Dogs—*cont.*
Parasites of—*cont.*
Spirochaetes, &c.—*cont.*
S. canis n. sp.: Accra, 93–4
S. regaudi, 96
S. unnamed, 96
Treponema pallidum-resembling, 94
Taenia: Accra, 282
Toxoplasma canis: Italy, &c., 237

Domesticated Animals
Diseases of, *see also, and chiefly, under* Names of Animals, *and* of Diseases
Myiasis in India, due to Maggots, 112
Parasites of
Ticks: Russia, and Russian Turkestan, 176–7

Donkeys, *see* **Asses**, *see also* **Equines**

Dourine, *see under* **Trypanosomiases**

Duck, Canadian
Parasite of
Leucocytozoon
L. anatis, 234

Dysentery, *see also* **Amoebiasis**
BACILLARY
in Dogs, Shanghai: Bacilli found, Persistence of, 45–6

RED, or Bovine Intestinal Coccidiosis: Italy, 163

East Coast Fever of Cattle, *see also* **Theileriasis**
Causal Agent, 236
Immunity, acquired, 292
Incidence
Age, 292
Geographical
Belgian Congo (suspected), 90-1, 109
Tunis, 230
Union of South Africa, 291–2
Prophylaxis
Dipping and Dips, 61–2, 132
Analysis, 286
Cost, 65
Dirty, inefficient, 287–8
Equipment, 286–8, 292
Formula, 65
Quarantine, 292
Rare in Masai Reserve, 128
Transmission by Ticks, 65, 128, 179
Ulcers in Abomasum in, resembling those of Rinderpest, 123

Edentates
Parasites of
Haematozoa: French Guiana, 91-2

Elephants
Parasites of
Cobboldia larvae: Belgian Congo, 28

Enteritis, Haemorrhagic, in Dogs: Brazil; due to Uncinariasis, 252

Entero-Hepatitis, or Blackhead in Turkeys, *see* **Blackhead**

Entomology
Acarinae
of Cattle, and other Animals: Belgian Congo, 29
Mite (unnamed) causing Rat-Disease: Accra, 283
Sarcoptes scabei of Goats, Transmissible to Man, 27
Spirochaetosis spread by, 143
Aegophagomyia pungens, of Goats: Zanzibar, 178
Anopheles of Nigeria, 70
Arthropoda
Blood-sucking: Australia, 252
Recent Literature, 78–80, 135–6
Vectors of Spirochaetosis, 143
Bembecinae (Cow-fly Tiger): British Guiana, Inimical to Tabanidae, 181
Auchmeromyia larvae, in Man and Animals: Congo, 27
Biting and Blood-sucking Flies, *see also* Anopheles; Glossina, *under* **Trypanosomiases**; Stegomyia; Stomoxys; Tabanidae, &c., *under* Names
Indian: Surra Transmission by, 67
Nigerian, 69–70
Protozoa found in, 70
Calliphorina, Chalcid Parasite of, as affecting *G. morsitans*, 176
Chalcids, Parasites of
Muscids, Ineffective with *G. morsitans*, 176
Tabanus albimedius, 111
Cheromyia Larvae of Animals (Pigs, &c.) and Man, 27
Chigoe, Chigger or Jigger Flea, *see Dermatophilus penetrans, and Sarcopsylla penetrans, infra*
Chrysomyia
C. bezziana = *megacephala*: Belgian Congo, Myiasis due to, 173, 174

Entomology—*cont.*
Chrysops
C. longicornis, of Asses : Zanzibar, 179
Cobboldia larvae, in Elephants : Belgian Congo, 28
Cordylobia
C. anthropophaga ; Myiasis due to
Belgian Congo, 173
Senegal, 174
C. murium, Rat-disease due to : German E. Africa, 174
Ctenocephalus
C. canis : Zanzibar, 179
Parasites of
Leishmania, 167
Leptomonas ctenocephali, 167
Possible Vector of Swine Septicaemia : Ceylon, 212
C. felis, on Goats : Zanzibar, 179
Incapable of Transmitting Surra, 111
Ctenopsylla musculi, Leptomonads of, Plate Culture of, 168
Culicidae : Australia, 251
Culex fatigans, *Filaria bancrofti* in, Sausage-like stage in, 106
Probable Vector of Canine Filariasis, due to *F. immitis*, 180
and Surra Transmission, 12
Culiciomyia : Nigeria, 70
Culicoides; in Stables: Philippines, 12
C. judicaudus, Experiments with, in Surra Transmission, 14
Dermatophilus penetrans, or Chigoe Flea
British Guiana, 181
Zanzibar, 179
Demodex folliculorum var. *bovis*, Cause of Demodectic Mange, 109
Distribution
America, 109
Belgian Congo, 109
Europe, 109
South America, 109
Diptera ; Blood-Sucking, of Eritrea, Incriminated as Transmitters of Trypanosomiasis, 253
Drosophilidae : Zanzibar, 179
Echidnophaga gallinacea of Fowls : Zanzibar, 179
Ectoparasites of Animals : Belgian Congo, 27, 28–9
Fleas, *see* Ctenocephalus, *and* Ctenopsylla, *supra*, *and* Pulicidae, *infra*
of Animals, and Fowls : Zanzibar, 179
Leptomonads of, 167–8
L. ctenocephali, 167

Entomology—*cont.*
Flies, *see* Biting, *supra*, *and under* Names
Gastrophilidae of
Belgian Congo, 20
Zanzibar, 179
Gastrophilus sp.. Infectious Anaemia of Cattle due to, 109
Glossina
Absence of, Spread of Disease in spite of, 221–2
Breeding of, at Pasteur Institute, Paris : 174–6
Dissections of, at Accra : Results, 18–19
Distribution
Cameroons and Togoland, 30
German East Africa, 29
Ivory Coast, 112
Nigeria, 69, 70
Principe, 27, 97
Sebungwe, 112–13
Senegal, 15–18
Siroko Valley, 113
Uganda, 76
External Diagnostic Characters of those of German East Africa, 29
Percentage of, Infective, 149, 150
Recent Literature, 78, 79, 80
Trypanosome and other Infections in, 18–19
Virus of ; Big Game as Reservoirs of, 16, 113, 150, 152
G. austeni, *see G. tachinoides*, *infra*
G. brevipalpis, 29, 151
G. caliginea, 30
G. fusca, 30
G. fusca-type, 112
G. longipalpis, 18, 30, 112
G. medicorum-type, 112
G. morsitans, 16–18, 29, 30, 76, 112, 148, 149, 150, 151, 221, 228, 229
G. nigrofusca-type, 112
G. pallicera, 30, 112
G. pallidipes, 29, 151
G. palpalis, 17, 18, 27, 29, 30, 69–70, 97, 112, 113–14, 151, 175, 228, 229
G. tabaniformis, 30
G. tachinoides, 29, 30, 69, 70, 112, 229
G. ziemanni, 30
Gnats : Zanzibar, 178
Leptomonas fasiculata, Parasite of, 167
Habronema sp., *see under* Spiroptera, *infra*
Haematopinidae
British Guiana, 181
Zanzibar, 179

Entomology—*cont.*
Haematopinidae—*cont.*
H. tuberculatus, the Common Cattle Louse, 181
on Calves: Australia, 251
Haematopota sp.
Belgian Congo, 29
Rhodesia, 222
in which Flagellates have been recorded, 15
as Vectors of Trypanosomes, 149, 222, 223, 253
Hippoboscidae, 221
Distribution
Asia, Southern, 253
British Guiana, 181
Egypt, 253
Eritrea, 253
Russian Turkestan, 106
Zanzibar, 179
Microfilariae in, 106
as Vectors of Trypanosomes, 149
H. maculata
Distribution, 253
Experiments with, in Surra Transmission, 14
in Stables, 12
Trypanosome carrier, 253
Hippocentrum versicolor: Nigeria, 69, 70
Hypoderma
H. bovis and *H. lineatum*; Anaphylaxis, Experimental, induced by, in Cattle and Sheep, 109–10
Insects Injurious to Man and Stock
Belgian Congo, 28–9, 173–4
British Guiana, 180–2
Eritrea, 253
Zanzibar, 178–80
Insects other than Glossina concerned in Transmission of Trypanosomes, 148 *et sqq.*, 253
Jigger, or Chigoe Flea, *see Dermatophilus penetrans*, *supra*, *and Sarcopsylla penetrans*, *infra*
Larvae producing Myiasis: Belgian Congo, 28–9, 173–4
Lice, *see* Haematopinidae *supra*, *and* Pediculi, *infra*
Liognathus vituli, of Calves: Zanzibar, 179
Locusts
Eradication of
Campaigns for
Algeria, 56
Morocco, 56, 210–11
Tunis, 55–6
Methods Employed
Biological, 55–6, 56–7, 210–11
d'Hérelle's Cocco-bacillus, 56
Recent Literature, 83

Entomology—*cont.*
Lucilia sericata larvae, Sore caused by: Belgian Congo, 174
Lynchia maura, of Pigeons
British Guiana, 180
Zanzibar, 179
Lyperosia sp., 12
Distribution
Australia, 251
Rhodesia, 222
as Vectors of Trypanosomes, 13, 148, 222
Maggots causing Myiasis; Flies bred out from: Pusa, 112
Mallophaga; British Guiana, 182
Mansonioides africanus: Nigeria, 69, 70
Melophagus ovinus (Sheep "louse")
Australia, 177–8
Peru, 272
Crithidia of, 167, 168, 169
Rickettsia of, 168
Vitality of; Experiments on, 177-8
Metazoan Parasites, Diseases due to, *see* that head
Mite, *see under* Acarinae, *supra*
Mosquitoes, *see also* Anopheles, Culex, Culicidae, Culiciomyia, Gnats, *supra*, *and* Ochlerotatus, *and* Stegomyia, *infra*
Vectors of
Bovine Onchocerciasis (suggested), 107, 108
Trypanosomiases, 227
Surra, 12–13
of Zanzibar, 178
Musca domestica
Infesting Stables, 249
Rôle of, in Surra Conveyance, 14
Spiroptera larvae in, in relation to Granular Equine Dermatitis, 249–50
Muscidae
Belgian Congo, 28–9
Myiasis due to, 173–4
British Guiana, 181
Eritrea; Trypanosome-Carrying, 253
Zanzibar, 179
Ochlerotatus sp.: Nigeria 70
Oestrinae, *see also Gastrophilus*, *supra*
Bibliography, 111
Distribution
Congo region, 28
Zanzibar, 179
Genera, Key to, and Descriptions of Certain Species, 111
Larvae
Characters of, 110
Found in
Antelopes, 174
Equines, 110
Goats, 179
Horn Cores of Ruminants, 110
Swine, 110

Entomology—*cont.*
Oestrinae—*cont.*
Revised Classification, 110
Warble fly; Extract of, Experimental Anaphylaxis obtained by, 110
Pangonidae
Eritrea, 253
Rhodesia, 222
Flagellate-harbouring, 15
Trypanosome-carrying, 222, 253
Pediculi
Belgian Congo, 29
Zanzibar, 179
Porcine and Human; Viability of, on Man and Pigs, 28
P. vestimenti, *Rickettsia prowazeki* of, 168
Philaematomyia crussirostris, Experiments with, in Transmission of Trypanosomiasis, 13–14
Phlebotomus sp., 12
Surra not Transmitted by, 14
Pulicidae
Belgian Congo, 29
British Guiana, 181
Zanzibar, 179
Pulex irritans, *Leptomonas* cultures from, 167
Pycnosoma flaviceps, Cause of Myiasis in Dog's Mouth: Ceylon, 212
Recent Literature, 78–80, 83, 135–6, 215
Sand flies: Australia, 251
Sarcophaga haemorrhoidalis, Myiasis due to: Belgian Congo, 173, 174
Sarcopsylla penetrans, of Pig and Man, 27
Sarcopsyllidae, of British Guiana, 181
Sarcopts of Goats, *see Sarcoptes scabei*, *under* Acarinae, *supra*
Sheep-Louse-fly, *see Melophagus ovinus*, *supra*
Stegomyia sp.: Nigeria, 70
S. calopus
Intermediate Host of *Paraplasma flavigenum*, 226
Possible Vector of Surra, 12
Stomoxydae
Distribution
Australia, 251
Belgian Congo, 29
British Guiana, 181
Eritrea, 253
Nigeria, 69
Rhodesia, 149, 222
Zanzibar, 179
Stable-infesting, 181, 249
Trypanosome-transmission by, discussed, 148 *et sqq.*, 223

Entomology—*cont.*
Stomoxydae—*cont.*
S. calcitrans
Distribution
Australia, 251
British Guiana, 181
Rhodesia, 149, 222, 223
Zanzibar, 179
Feeding habits of, and the Common House Fly as Vector of Surra, 15
Possible Vector of Bovine Onchocerciasis, 107, 108
as Vector of Trypanosomiasis, 148, 149, 181, 222, 223
S. nigra, as Vector of Trypanosomiasis, 223
Tabanidae
Distribution
Australia, 251
Belgian Congo, 29
British Guiana, 181
Ceylon, 212
Dutch East Indies, 225
Eritrea, 253
India, 111
Nigeria, 69, 70
Rhodesia, 222
Zanzibar, 178
Equine Surra in connection with: Dutch East Indies, 225
Flagellate-harbouring, 15
Insect Enemies of, 181
Possible Vectors of Bovine Onchocerciasis, 107, 108
Species found at Pusa (India)
Life-Histories, 111
Transmission Experiments with, 111–12
Species referred to
T. albimedius, 111, 112
T. cinerescens, 251
T. cordieri, 253
T. fuscipes, 222
T. glaucopis, 169
T. gratus, 169
T. hilaris, 111
T. nemocallosus, 111
T. sanguineus, 111
T. striatus, 10, 12, 111, 112
T. taeinola, 222
Surra Transmission by
Dutch East Indies, 225
Species capable of: Pusa
T. albimedius, 111, 112
T. striatus, 10–12, 111, 112
Trypanosome-carrying, 169
Actual, and Suspect, in
Dutch East Indies, 225
Eritrea, 253
India (Pusa), 111
Rhodesia, 221–2
Zanzibar, 178

Entomology—*cont.*
Tabanidae—*cont.*
Trypanosome-carrying—*cont.*
Transmission Experiments with, on
T. evansi, 223
T. rhodesiense, 223
Ticks
Diseases due to, or Spread by, *see* **Anaplasmosis; East Coast Fever; Nairobi Sheep Disease; Piroplasmosis; Red Water,** *&c.*
Distribution; Species found in
Belgian Congo, 29
British Guiana, 180–1
French Guiana, 92
India, 112
Other Countries, 235, 236
Russia, 176–7
Russia Turkestan, 176
South Africa, 275
Turkey, 231
Zanzibar, 179–80
Feeding Experiments with, on Cattle Piroplasmosis, 230–1
Intermediate Hosts of various Piroplasms, &c., 235, 236
Species referred to
Amblyomma, 92, 177, 179
Argas, 29, 177, 180
Boophilus, 179, 212, 231, 235, 251
Dermacentor, 235, 261, 275
Haemaphysalis, 180
H. leachi, 235
Hyalomma, 177, 179–80
Ixodes, 29, 176–7, 180, 231, 235, 275
Margaropus, 177, 180
Ornithodorus, 27, 29, 112
Redlegged, 286
Rhipicephalus, 128, 130, 131, 132, 177, 179, 180, 231, 235, 236, 255
Trichodectes: British Guiana, 182
Tsetse-fly, *see* Glossina, *supra*
Wasps, *see* Bembecinae, *supra*

Ephemeral Fever, or Three Days' Sickness in Cattle: U.S. Africa, 293

Epithelioma Contagiosum, in Mexican Quails, 48

Epizootic Lymphangitis, *see* **Lymphangitis, Epizootic**

Equines, *see also* **Donkeys, Horses** *and* **Mules**
Diseases of
Abortion: India, 67

Equines—*cont.*
Diseases of—*cont.*
Acne, Contagious: Germany, 201
Anaemia, Infectious
Incidence
British East Africa, 64
Dutch East Indies, 257–66
U.S.A., 191
Anaplasmosis, with Complications: Russian Turkestan, 148
Anthrax
Incidence
Assam, 283, 284
Trinidad, 291
Cellulitis, Ulcerative: France, 255-6
Cutaneous, Unnamed, due to Preiz-Nocard Bacillus: B.E. Africa, 188
Dermatitis
Granular
Incidence
British East Africa, 63
Lower Congo, 248–50
Ulcerative: Belgian Congo, 46
Filariasis
Incidence
Accra, 61
Austria, 247
Egypt, 247
Hungary, 237–48
Russian Turkestan, 105
Turkestan, 238, 247
Glanders
Incidence
Assam, 283
British East Africa, 290
India, 204
U.S. Africa, 290, 293
"Grease," in Heels, 200
Horse Sickness
Incidence
B.E. Africa, 62, 64, 290
Rhodesia (low Mortality), 213
South Africa, 62
U.S. Africa (Mild), 294
Prophylaxis, 62
Influenza
Fowl Cholera-type Organisms in, 254
Incidence
Ceylon, 213
Rhodesia, Southern, 213
Trinidad, 291
Kumri
Incidence
Assam, 284
India, 67
Lymphangitis
Epizootic, 7–43, 62, 64, 114–17, 182–7, 290
Incidence
Geographical
Algeria, 37, 40, 184, 185
B.E. Africa, 62, 64
Decrease in, 290

Equines—*cont.*
Diseases of—*cont.*
Lymphangitis—*cont.*
Epizootic—*cont.*
Incidence—*cont.*
Geographical—*cont.*
France, 39, 40, 182 *et sqq.*
India, 41
Italy, 186
Morocco, 37, 40, 41, 42, 182, 184, 187
North Africa, 40
Senegal, 42, 184
South Africa, 41
Sudan, 41
Uganda, 76
U.S. Africa, 293
Local, 42–3, 182
Season, 42, 43
Two Varieties, 114
Atypical, 114–15
Typical, 115–16, 187
Ulcerative, *see also* **Cellulitis, Ulcerative,** 41, 62, 64, 187–8, 255, 290
Incidence
British East Africa, 62, 64, 188, 290
France, 187–8, 255–6
Mange or Scabies: U.S. Africa, 293
Symbiotic: Belgian Congo, 29
Nuttalliasis, *see infra, under* Piroplasmosis
Piroplasmosis or Babesiasis, 69
Incidence
Macedonia, 260, 261
Russian Turkestan, 146
West Indies, 148
Nuttalliasis
Incidence
Africa, 235
Annam, 235
Brazil, 235
India, 235
Italy, 235
Russian Turkestan, 146
Transcaucasus, 147, 235
Pneumonia, Contagious
Incidence
British Guiana, 212
England, 277–80
Septicaemia, Haemorrhagic
Incidence
India, 254
U.S.A., 254
Spiroptera Invasion, *see* Dermatitis, Granular, *supra*
Sporotrichosis: Montana, 44–5
Stomatitis, Pustular, Contagious: U.S.A., 201 *et sqq.*
Strangles
Incidence
British East Africa, 290
India, 67
Trinidad, 291

Equines—*cont.*
Diseases of—*cont.*
Trypanosomiases
Incidence: All forms
Assam, 283
Accra, 60
British Guiana, 181
French West Africa, 17
Gold Coast, 282
India. 12, 284
Mauritius, 12
Nigeria, 70, 74–5
Philippines, 12
Mal de Caderas, 159
British Guiana, 181
Surra
Incidence
Assam, 283
Dutch East Indies, 222
India, 12, 284
Mauritius, 12
Nigeria, 74–5
Philippines, 12
Variola, in relation to Stomatitis (*q.v. supra*), 200 *et sqq.*
Insects Infesting, 12, 14, 28, 29, 110, 179
Parasites of
Filaria and Microfilaria
Accra, 61
Russian Turkestan, 105
Fowl-Cholera type Organisms, 254

Ferrujão, of Bovines: Portugal; due to *Piroplasma divergens*, 235

Filariasis, *see under* **Helminthiasis**

Filterable Viruses, Diseases Due to, 47-54, 118-32, 191–200, 257–67
Equine Influenza probably classed with, 254
Recent Literature, 81–2, 138, 217-18, 301–3

Fish
Parasite of
Leucocytogregarina ninae kohl-yakimovi: Caucasus, 104

Foot and Mouth Disease, 47–8, 197–200
in Animals other than Bovines: Assam, 283
Bovine
Blood in, Virulence of, 197 *et sqq.*
Differentiation of, from Contagious Pustular Stomatitis, 205, 206
Immunisation Experiments, 197, 199–200
Low Mortality: India, 285

Foot and Mouth Disease—*cont.*
Bovine—*cont.*
Lesions in Rumen, 47–8
Mild type : Uganda, 289
Myocarditis present with : France, 197
Incidence : all Animals
Argentina, 271
Assam, 283
B.E. Africa (Control of), 289
Ceylon (Decrease), 212
France, 197
India, 285
Nigeria, 69
Peru, 27
Uganda, 76, 289

Foot-Rot, Contagious, in Ovines : B.E. Africa, 290

Fowl-Cholera, or Kikuyu Fowl Disease : British East Africa, 62, 66

Fowl-Cholera-Type Organisms, in relation to Equine affections, 254

Fowl Pox, in Mexican Quail, 48
Nature ; Symptoms ; Transmission Experiments, 48

Fowl Spirochaetosis : Senegal, 142–3

Fowls (Poultry), *see also* **Birds** *and under* Names of Birds
Diseases of, *see* **Fowl Cholera** ; **Fowl Pox** ; **Fowl Spirochaetosis**
Insects Injurious to
British Guiana, 180
Zanzibar, 179
Parasite of
Spirochaeta marchouxi : Accra, 281

Fox
Parasite of
Theileria, Ring-form : Russian Turkestan, 147

Frogs
Parasites of
Microfilariae, Sheathed : Russian Turkestan, 106
Trypanosomiasis, Experimental, in, 170–1

Gall-Lamziekte, *see* **Lamziekte**

Gall-Sickness, *see under* **Anaplasmosis**

Game, Big, as Reservoirs for Tsetse Virus 16, 113, 150, 152

Gastro-Enteritis
Epizootic, of Dogs : Stuttgart, 253
Verminous, in Ovines : British East Africa, 290

Gazelles
Disease of
Caenurosis, 36
Parasites of
Theileria (Grant's Gazelle) : Africa
T. stordii, 236

Geel-Dikkop, in Ovines : U.S. Africa, 293–4
Seasonal Incidence, 294

Glanders
Diagnosis of, by Conglutination Method, 155
Differentiation of, from Epizootic Lymphangitis, 40, 41 *et sqq*
Equine
Incidence
Assam, 283
British East Africa, 290
India, 284
South Africa, 290
Union of South Africa, 293

Goats
Diseases of
Agalaxy, Contagious : Algeria, 209-10
Babesiasis, *see* Piroplasmosis, *infra*
Mange, Sarcoptic, 27–8
Myiasis ; Ulcers of Legs, due to *Chrysomyia bezziana* larvae : Belgian Congo, 174
Piroplasmosis
Incidence
German East Africa, 146
Nigeria, 69
Russian Turkestan, 146
Transcaucasus, 146
Pleuropneumonia, Contagious
Incidence
B.E. Africa, 62, 66, 290
Italy, 55
Exudative Form
Incidence
Albania, 55
Italy, 55
Serbia, 55
Psoroptic Otacariasis : Belgian Congo, 29
Rinderpest : Egypt, 123
Trypanosomiasis : French West Africa, 17
Glossina Infesting : Accra, 19
Immunity of, to Rinderpest : Eritrea, 128
Insects Injurious to : Zanzibar, 178, 179

Goats—*cont.*
Parasites of
Piroplasma, or Resembling: Russian Turkestan, 146
Spirochaetes
S. eurygyrala-type: Accra, 93, 94
Theileria
Probable: Russian Turkestan, 146
T. mutans-type: German East Africa, 146
Sarcopt of, Transmissible to Pigs and Men, 27–8

Gondi
Disease of
Toxoplasmosis of: Tunis, 165

"Grease," in Horses' Heels, 200

Great Gall, *see* **Rinderpest**

Guinea-Pigs
Diseases of
Rabies, Experimental, 192–4
Vaccinia, Generalised, 54

Haematuria, Bovine
Complications, 268
Etiological Theory: Oxalic Acid: Experiments on, 267–9
Fatality, 269
Incidence
Age, 268
Geographical
Australia, 269
Canada, 267, 269
Hawaii, 269
Locale, 268, 269
Seasonal, 267
Prophylaxis, 269
Symptoms, 267–9

Haemorrhagic Septicaemia, *see* **Septicaemia, Haemorrhagic**

Helminthology
DISEASES, and Parasites associated with them

ANKYLOSTOMIASIS, or Uncinariasis
Canine
Incidence
Accra, 281–2
Brazil, 252–3
Sierra Leone, 281
Parasites found, 106, 180, 252, 253, 280, 281–2
Ankylostoma
A. caninum
in Dogs
Lagos, 282
Sierra Leone, 281

Helminthology—*cont.*
DISEASES, &c.—*cont.*
ANKYLOSTOMIASIS—*cont.*
Canine—*cont.*
Parasites found—*cont.*
Ankylostoma—*cont.*
A. ceylanicum
in Dogs
Accra, 281–2
Sierra Leone, 281
A. ceylanicum-type in Dogs: British Guiana, 180
A. duodenale
Larvae of: Skin Irritation due to, 250
A. tubaeforme in Dogs: Stuttgart, 253
Uncinaria
U. stenocephala, in Dogs, 282
Disease due to: Brazil, 252–3
Post-mortem Findings, 252
Symptoms, 252

CAENUROSIS, in Gazelle, 36

DERMATITIS, GRANULAR EQUINE
Causal Agent, 248–50
Incidence
Geographical
British East Africa, 63
Lower Congo, 248–50
Locale, 249
Transmission by Flies, 249

FILARIASIS
Canine
Causal Agent, 106, 180, 247
Incidence
British Guiana, 180
Russian Turkestan, 106
Equine
Causal Agent, 246, 247 *et prosvi*
Incidence
Austria, 247
Egypt, 247
Hungary, 237–48
Russian Turkestan, 105
Turkestan, 238, 247
Microfilariae of
Morphology and Biology, 240–8
Adult Stage, 246–8
Technique of Examination for, 239–48
Prognosis, 239
Symptoms and Blood Conditions, 61, 238–9
Compared with those in Man, 248
Human
Filaria associated with, 247

Helminthology—*cont.*
Diseases, &c —*cont.*
Gastritis, Parasitic, in Sheep, due to *Haemonchus contortus*, 30–5
Due to the same in British East Africa, 63, 64
in Ceylon, 212.
in Peru, 276

Onchocerciasis
Bovine
Incidence
Africa, 172
Annam, 172
Australia, 107, 171–2, 250–2
Egypt, 172
India, 172
Malaya, 172
South America, 36–7
Sumatra, 172
Parasites of, 36–7, 107, 172, 250–2
Prophylaxis, 252
Symptoms, 36–7
Transmission Problems, 251, 252
Aortic: Senegal, Parasite and Symptoms, 171–2

Sheep-rot, from Liver-Fluke
Incidence
Italy and Sardinia, 3
Peru, 275

Spiroptera Infection in Equines
Incidence
British East Africa, 63
Lower Congo, 248–50
Habronema sp.
H. muscae, in Equines, 249

Taeniasis, in Dogs, with Intussusception: Accra, 281
Wireworm Infection in Sheep, &c., *see* Gastritis, Parasitic, *supra*
Treatment by Lysol, 63

Parasites, other than those grouped with Diseases, *supra*
Ascaris, in Dog: Accra, 282
A. megalocephala, in Horse: British Guiana, 180
Cysticercus tenuicollis, in Sheep: Peru, 276
Dicrocelium, in Cats: British Guiana, 180
Dictyocaulus filaria, in Sheep: Peru, 275
Echinorynchus gigas, in Pigs: British Guiana, 180
Fascicla hepatica, in Sheep, 3, 275

Helminthology—*cont.*
Parasites—*cont.*
Filariae and Microfilariae
bancrofti, 247
Discovery of, Intermediate Host and Developmental Changes of, 247 *n.*
Embryos, some resembling, in Bovines: Russian Turkestan, 106
Periodicity of, 245
camelensis: Africa, 106
Periodicity of, 245
cervina, in Cow: B. Guiana, 180
immitis, of Dogs, 180, 247
One resembling, 106
irritans, in Equine Granular Dermatitis, 248–9
kerandeli, in Edentate: French Guiana, 91, 92
labiato-papillosa, Embryo of; one like, in Bovines: Russian Turkestan, 106
loa, 247
Periodicity of, 245
ninae kohlyakimovi, in Equines: Russian Turkestan, 105
papillosa, Early Stage of, 246, 247 *et proevi*
sanguinis equi, Periodicity of, 245
sanguinis hominis
Discovery of, and Concerning, 247 *n.*
Unnamed, in
Birds: Senegal, 106–7
Dogs: Accra, Sheathless embryos, 281
Edentates: French Guiana, 91
Frogs: Russian Turkestan, 106
Horses
Accra (embryo), 61
Hungary; Biology and Morphology of, 237 *et sqq.*
Man, and other Mammals: Senegal, 171
Haemonchus (Strongylus) contortus
Anatomy and Biology, 30–5
Mode of Infection by, 34
Monezia expansa, in
Pigs: British Guiana, 180
Sheep: Peru, 276
Oestophagostomum
O. columbianum, in Sheep: British East Africa, 64
O. radiatum, in Sheep: Peru, 276
Onchocerca
O. armillata
Countries in which found, and Animals Infested by, 172

Helminthology—*cont.*
Parasites—*cont.*
Onchocerca—*cont.*
O. gibsoni
Compared with the Onchocerca of South America, 36
Nodules due to, in Cattle: Australia, 250–2
Physaloptera, of Cats: British Guiana, 180
Taenia, in Dog: Accra, 282
Trichocephalus affinis, in Sheep: Peru, 275
Wireworm, in Sheep, &c.: British East Africa, 63
Recent Literature, 80–1, 136–7, 215–17, 300

Herons
Parasites of
Microfilaria: Senegal, 106
Trypanosomes: Nigeria, 71

Hippopotamus, Oestrine larvae peculiar to, 110

Hippotragus equinus
Parasites of
Theileria hippotragi, 236, 281

Horse Leeches
Well-Infestation by: Morocco; Native Treatment, and Prophylaxis, 172–3

Horse Pox, Jenner's, *see* **Variola, Equine**

Horse Sickness
Inciden e
Briti h East Africa, 62, 64, 290
Rhodesia, Southern (Low Mortality), 213
South Africa, 62
Union of South Africa, 294

Horses, *see also* **Equines**
Breeding Experiments with: Ceylon, 212
Diseases of
Acne, Contagious: Germany, 201
Anaemia, Infectious: Dutch East Indies, 257–60
Anthrax: Trinidad, 291
Cow pox, 200
in Holland, 201
Filariasis
Incidence
Accra, 61
Austria, 247
Egypt, 247
Hungary, 237–48
Russian Turkestan, 105
Turkestan, 238, 247

Horses—*cont.*
Diseases of—*cont.*
Glanders
Incidence
Assam, 283
British East Africa, 290
India, 284
Union of South Africa, 290 293
"Grease," in Heels, 200
Horse Sickness
Incidence
South Africa, 62
U.S. Africa (Mild form), 294
Influenza
Incidence
Ceylon, 212
Rhodesia, Southern, 212
Trinidad, 291
Kumri
Incidence
Assam, 284
India, 67
Lymphangitis
Epizootic, 37 *et sqq.*, 114 *et sqq.*, 182 *et sqq.*, 290
Incidence, *see under* Disease
Two forms, 114–15
Ulcerative, 41, 62, 64, 187–8, 255, 290
Incidence, *see under* Disease
Mixed Infection in, Anaplasma and *N. equi*, 148
Nuttalliasis, alone, or associated with Piroplasmosis: Russian Turkestan, 146, 147
Incidence
Africa, 235
Annam, 235
Brazil, 235
India, 235
Italy, 235
Russian Turkestan, 146, 147
Transcaucasus, 235
Pataleta: Argentina, 270]
Piroplasmosis
Incidence
Macedonia, 261
Roumania, 235
Russia, 235
Russian Turkestan, 146
Siberia, 235
Transcaucasus, 235
West Indies, 148
Pneumonia, Septic or Contagious: Enquiry into, 277–80
Stomatitis, Contagious Pustular, 200 *et sqq.*
Trypanosomiases: Gold Coast, 282
Dourine: U.S.A., 191
Surra: Dutch East Indies: Seasonal Incidence, 225
Variola (Jenner's Horse Pox), 200 *et sqq.*

Horses—*cont.*
Parasites of
Ascaris megalocephala: British Guiana, 180
Filariae and Microfilariae
ninae kohlyakimovi Russian Turkestan, 105
Nuttallia equi
Distribution, 235
Intermediate Host, 235
Piroplasma caballi
Distribution and Intermediate Host, 235

Icterohaemorrhagica, due to Spirochaetes, 143

Infectious Anaemia, Equine, *see* **Anaemia,** INFECTIOUS, EQUINE

Infectious Stomatitis, *see* **Stomatitis, Contagious, Pustular**

Influenza, Equine, Fowl-Cholera-type Organisms in, 254
Incidence
Ceylon, 212
Rhodesia, Southern, 213
Trinidad, 291

Intussusception, of Small Intestine in Dogs, with Tapeworm: Accra, 281

Jackals
Immune to *Piroplasma canis*, 146
Parasites of
Piroplasma
P. gibsoni: Madras, 146
P. rossi: Africa, 146

Jhooling, or Jhoolak, in Camels: Punjab; Causal Agent: Treatment, 173–4

Kikuyu Fowl Disease, *see* **Fowl Cholera,** *supra*

Kiolo, *see* **Myiasis, Cutaneous,** *infra*

King's Aptha, *see* **Stomatitis, Contagious Pustular,** *infra*

Kumri, in Equines
Incidence
Assam, 284
India, 67

Laboratory Work, *see* **Reports**

Lambs, *see* **Sheep and Lambs**

Lamziekte, U.S. Africa, 293

Leeches
Parasite of
Trichomonas: Turkestan, 165–6

Leishmaniasis, 89–90, 141–2, 294–6
CANINE
Experimental; Post-mortem findings, 141

MEDITERRANEAN
Leptomonads of Fleas associated with, 167
Mixed Infection, with Anaplasmosis: Russian Turkestan, 148

ORIENTAL SORE, in Mice, 142
Experimental, in Monkeys, 142

Parasites
Leishmania
Flagellate affinities of, 237
Locale of, 141
Resemblance of, to Leptomonas, 167
L. donovani
Lethal properties of, 26
Plate Cultivation of, 168
L. tropica
Infection in Mice, 142
Pathogenicity of: Experiments on, with Monkeys, Dogs, and Rodents, 89, 90
Recent Literature, 77, 78
Review of Laveran's Book on, 294–6
Treatment by Tartar Emetic, 24

Live Stock Population
Bulgaria (1910), 260
Turkey (*circa* 1917), 263

Liver-Fluke, *see* Fasciola Hepatica, *under* **Helminthiasis**

Lizards
Parasites of
Haemogregarina
H. unnamed: Accra, 160
H. weinbergi: French Guiana, 165
Plasmodia
P. carinii: French Guiana, 105
P. praecox: West Africa, 105
Pirhemocyton, or *Pyrhemocyton*
P. tarentolae, 105

Llamas
Disease of
Renguera, or Enzootic Paraplegia: Peru, 271, 274

Louping-Ill, in Sheep: Great Britain, 275

Lumbar Prurigo, or Scrapie in Sheep : Great Britain, 275

Lung Sickness, *see* **Pleuropneumonia, Contagious,** Bovine

Lymphangitis, of Equines
EPIZOOTIC, 37–43, 114–17, 182–7
Conditions rendering Acute, 182
Diagnosis, 38
Differentiation of, from Glanders, 40, 41 *et sqq.*
Economic aspects, 37, 38
Flies as Vectors, 41, 42, 43, 182
Incidence
Geographical
Algeria, 37, 40, 184, 185
British East Africa, 62, 64
Decrease in, 290
France, 39, 40, 182 *et sqq.*
India, 41
Italy, 186
Morocco, 37, 40, 41, 42, 182, 184, 187
Senegal, 42, 184
South Africa, 41
Sudan, 41
Uganda, 76
U.S. Africa, 293
Local, 42–3, 182
Seasonal, 42, 43
Incubation period, 39, 42
Length of, in
France, 183–4
Morocco, 182
Parasite
Cryptococcus farciminosus, 183
Alternative Name, 40
Cultivation, 41, 116–17
Transmission, 38
True Nature, 40
Prophylaxis
Isolation, 40
Lazarets, 38
Recent Literature, 81
Symptoms and Post-mortem Findings, 41, 114–16, 182–3, 184
Ulcerative Lesions of Pituitary Mucous Membrane, 41
Treatment
Literature on, Review of, 186
Means Employed
Alcoholic Picric Acid, 185
Arsenivan, 186
Cauterisation, 39, 40, 184–5
Copper Sulphate, 39–40
Galyl, 40, 183
Iodine-Methylene Blue, 182–3
Iodine, Tincture of, 39, 182, 183, 185
Mercurial Compounds, 185–6
Mercurial Cream, 64

Lymphangitis—*cont.*
EPIZOOTIC—*cont.*
Treatment—*cont.*
Means Employed—*cont.*
Methylene Blue, 182, 183, 185
Novarsenobenzol, 38, 40, 41, 183
Petrol, 41
Pot. Iod., 38, 39, 40
Pot. Iod. with Biniod. of Mercury, 64
"606," 64
Surgery, 38, 39, 41, 42, 184, 185
Vaccine, 186–7
Zinc Chloride, 41
Two Varieties of, 114
Atypical
Forms, 115
Lesions, 114–15
Typical
Clinical sign of, 182
Forms, 115
Lesions, 114, 115–16

ULCERATIVE (*see also* **Cellulitis, Ulcerative**), 41, 62, 64, 187–8, 255
Bacteriology
Preiz-Nocard Bacillus, Causal Agent, 64, 187, 255
Present in Soil : British East Africa, 290
Streptothrix present in, 64
Incidence
British E. Africa, 62, 64, 188, 290
France, in Army Horses, 107–8, 255–6
Symptoms, 182–3, 255
Treatment by Vaccine, 64, 187–8, 255–6

Magpies
Parasite of
Leucocytozoon berestneffi : France, 104

Malaria
AVIAN, 6, 164
Parasites of
Proteosoma vel *Plasmodium relictum*, 164
Proteosoma praecox ; Morphological Studies on, 6
Relative Immunity-period in, 164

EQUINE, *see* **Piroplasmosis**

HUMAN
Not connected with Avian (*q.v.*), 164
Parasite of ; Unicity of, 164

Mal de Caderas, *see under* **Trypanosomiases**

Mange
Auricular Psoroptic, of Rabbits; Belgian Congo, 29
Demodectic, of Cattle
Causal Agent, 109
Incidence
Belgian Congo, 109
Europe, 109
Nyasaland, 109
South America, 109
Symptoms, 109
in Horses, *see* **Scabies, Equine**
Sarcoptic, Caprine and Porcine; Transmissible to Man, 27–8
Symbiotic, of Horses: Belgian Congo, 29

Mbori, *see under* **Trypanosomiases**

Mediterranean Coast Fever, due to *Theileria parva*, 236

Metazoan Parasites
Diseases due to, 27–37, 105–14, 171–82, 237–53, 291
Recent Literature, 78–81, 135–7, 215–17, 298–300

Mice
Field, *see also* **Shrew Mice,** *infra*
Parasite of
Theileria rossica, 104
House
Diseases of
Oriental Sore, 142
Trypanosomiasis
Dourine, Experimental Treatment of, 154
Parasites of
Anaplasma, unnamed: Transcaucasus, 104
Grahamella: Dakar, 144
Leishmania tropica, 142
Leucocytogregarina
L. musculi
Incidence
London, 105
Petrograd, 105
Turin, 105
Trypanosoma duttoni: Morocco 158

Miscellaneous, 55–7, 133, 200-11, 267–80, *see* Separate Headings for all Topics dealt with under this Term
Recent Literature, 82–4, 139–401, 219–20, 303–4

Mite Disease, in Experimental Rats: Accra, 283

Moles
Parasite of
Elleipsisoma sp., 237

Monkeys
Diseases of
Amoebiasis
Incidence
Accra, 1
U.S.A., 2
Live Abscess
Incidence
U.S.A., 2, 3
Leishmaniasis
Oriental Sore: Experimental, 142
Vaccinia, Generalised, 53, 54
Parasites of
Leishmania tropica, Pathogenic to; Experiments on, 89
Spirochaetes
S. eurygyrata-type: Accra, 93, 94
Variolar Immunisation of, 54

Mules, *see also* **Equines**
Diseases of
Haemorrhagic Septicaemia: India, and U.S.A., 254
Pneumonia, Contagious: British Guiana, 212
Strangles: Trinidad, 291
Trypanosomiasis: Gold Coast, 282

Mycotic Diseases, 37–45, 114–17, 182-7; *see* **Dermatitis, Tropical Bovine; Lymphangitis, Epizootic; Pleuro-Pneumonia of Goats** (alleged); **Sporotrichosis**
Recent Literature, 81, 138, 217, 300-1

Myiasis
in Various Animals, with Causal Agents (*q.v. also under* Entomology)
Incidence
Belgian Congo, 28–9, 173–4
Ceylon, 212
German East Africa, 174
Senegal, 174
Study of, 173
Criticism on, 174

Myocarditis, with Foot-and-Mouth Disease, in Cattle: France, 197

Nagana, *see under* **Trypanosomiases**

Nairobi Sheep Disease, 66, 128–32 290
Bacteriology, 130–1
District chiefly affected, 128

Nairobi Sheep Disease—*cont.*
Immunity
Artificial, 131–2
Natural, 131
Incidence, Geographical
B.E. Africa, 66, 128–32, 290
Mortality, 128, 129
Observations on
Field, 128
Laboratory, 128 *et sqq.*
Prophylaxis
Dipping, 132
Rare in Masai Reserve, 128
Symptoms, and Post-mortem appearances, 128–9
Transmission by Ticks (*Rhipicephalus appendiculatus*), 128, 130, 131, 132

Nambiuvú, in Dogs: Brazil, due to *Rangelia vitalli*, 236

Onchocerciasis, *see under* **Helminthiasis**

Ophthalmia, Infectious, in Cattle: Ceylon, 212

Oriental Sore, *see under* **Leishmaniasis**

Osteomyelitis, Infectious Equine, *see* **Anaemia, Infectious**, EQUINE

Otacariasis, of Sheep and Goats, *see* Psoroptic Otacariasis, *under* **Acariasis**

Ovines, *see* **Sheep**, *and* **Lambs**

Owls
Parasites of
Leucocytozoon ziemanni: France, 104
Trypanosoma syrnii; Plate Cultivation of, 169

Oxen, *see* **Bovines**

Paralysis, Tick-Spread, in Sheep
Incidence
British Columbia, 275
Cape Colony, 275

Paraplegia, Enzootic, or **Renguera**, in Lambs and Adult Sheep: Peru, 269–77
Bacteriological Findings
Diplococcus, or Micrococcus, 272–3, 276–7
Breeding Season Changes in regard to, 277
Contagious character of, 269, 270

Paraplegia, Enzootic—*cont.*
Economics of, 271–273
Experimental Studies on, 272–3
Fatality of, 270, 271, 273, 274–5
Incidence
Age, 269, 270, 271, 277
Locale, 270, 271
Season, 271, 277
Other Animals alleged to Suffer from, 271, 274
Post-mortem Findings, 275
Prophylaxis, 273, 277
Symptoms, 269–72, 274
Transmission by
Contagion, 269, 270, 271
Importation of Sheep, &c., 271
Transmission Experiments, 273

Pataleta, La
Animals attacked by, 270, 271, 274
Etiological Theories, 270
Incidence
Argentina, 270, 271
Symptoms, 270, 271

Pigeons
Parasites of
Haemoproteus colombus, 234
Lynchia maura
British Guiana, 181
Zanzibar, 179

Pigs, *see* **Swine**

Piroplasmoses (PIROPLASMOSIS or BABESIASIS, NUTTALLIASIS, and THEILERIASIS), 59, 69, 90–2, 145–8, 230–1; *see also* **East Coast Fever**

BABESIASIS or PIROPLASMOSIS
Animals affected
Bovines, 59, 69, 71
Equines, 69
Ovines, 59, 69, 71, 146
Swine, 59, 90

BOVINE (Redwater)
Complication of Rinderpest, 125, 265, 266
Distribution, *see* Incidence, *under* Bovine Diseases, Piroplasmosis
Incidence
Accra, 59–60
Nigeria, 69, 71
Prophylaxis, 111
Treatment, 111
Vector, 111

CANINE: Accra, due to *P. canis*; Symptoms and Treatment, 281

Piroplasmoses—*cont.*
BABESIASIS, &c.—*cont.*
EQUINE
Distribution, 146, 148, 260, 261
Piroplasms in Blood in, 261
Symptoms, 148, 261
Ticks in relation to, 111, 261

Incidence, All forms, in all Animals affected
Africa, 146, 235
America, 235
Asia, 235
Australia, 235
Egypt, 111, 235
German East Africa, 146
India, 146
Italy, 231, 235
Nigeria, 69, 71
Portugal, 235
Roumania, 235
Russia, 235
Russian Turkestan, 145–7
Sardinia, 235
Siberia, 235
Transcaucasia, 146, 231, 235
Tunis, 230–1
Turkey, 231
West Indies, 148

OVINE; Distribution, 146, 147, 235
P. ovis in, 146, 235
with Theileria, 14
Parasites
Piroplasma, or Babesia, *q.v. infra*
Long Latency of, 266
P. annulatum, in Cattle, 231
P. bovis, in Cattle: Italy, 231
Host, Intermediate Host and Distribution, 235

Parasites
Piroplasma or Babesia
P. bigeminum at
Accra, 59
G.E. Africa, 125
in Cattle, 231, 235
Morphology, 145
Redwater Fever ascribed to: Great Britain, 235 *n.*
P. caballi, 146
Host, Intermediate Host, and Distribution, 235
Symptoms due to, 146, 147
P. canis, in Dogs: Accra, 281
Host, Intermediate Host, and Distribution, 235
Jackals immune to, 146
P. canis-type, in Wolf, 146, 147

Piroplasmoses—*cont.*
BABESIASIS, &c.—*cont.*
Parasites—*cont.*
Piroplasma or Babesia—*cont.*
P. divergens
Ferrujaô, of Bovines: Portugal, due to, 235
Host, Intermediate Host, and Distribution of, 235
P. gibsoni, in Jackals, and Dogs: Madras, 146
P. mutans
Accra, 59
German East Africa, 125
P. ovis
Distribution, 146, 235
Host, Intermediate Host, and Distribution, 235
Transmission by Swine, 96
with Theileria: Russian Turkestan, 146
P. parvum (*Theileria parva*), in Cattle: Tunis, 230
P. rossi, in Jackal: Africa, 146
Unnamed: in Cow: Accra, 281
Recent Literature, 78, 214
Transmission by
Eating Infected Meat, 90
Experimental Infection, in Small Rodents, 90
Ticks, 90, 111, 231, 235
Treatment by
Arrhenal, 111
Trypan Blue, 145
Vaccine, 71

NUTTALLIASIS
Animals affected by
Equines, 147, 148, 235
with Anaplasmosis, 148
Rodents: Accra, 60, 61, 283
Causal Agent, 235
Incidence
Africa, 235
Annam, 235
Brazil, 235
India, 235
Italy, 235
Russian Turkestan, 146,
Transcaucasus, 147, 235
Parasites
Nuttallia
N. decumani, in Rats: Accra, 60, 61, 283
N. equi, 147
Disease due to, 235
Distribution, 235
Host, Intermediate Host, and Distribution, 235
Treatment by Trypan Blue, 147

Piroplasmoses—*cont.*
THEILERIASIS
Animals affected
Antelopes, 236, 281
Bovines
Amakebe, East Coast Fever, Mediterranean Coast Fever, due to *Theileria parva*, 236
Symptoms, and Causal Agent: Russian Turkestan, 147
Theileria associated with, in Various Lands, 236
Ticks associated with, 236
Camels: Russian Turkestan; *T. camelensis* in, 147
Sheep, with Piroplasmosis: Russian Turkestan, 146
T. ovis in, 147
Incidence
Abyssinia, 236
Africa, 236
East Coast of, 236
Portugal, 236
Rhodesia, 236
Russia, 236
Uganda, 236
Parasites
Theileria
Ring-shaped, in Fox: Russian Turkestan, 147
T. annulata
in Bovines: Russia, 236
Host, Intermediate Host, and Distribution, 236
T. brimonti, in Edentates: French Guiana, 91–2
T. camelensis: Russian Turkestan, 147
T. dama, in Stag: Portugal, 236
Host, Intermediate Host, and Distribution, 236
T. hippotragi in
Africa, 236
Gambia, 281
Host, Intermediate Host, and Distribution, 236
T. mutans, in Bovines: Africa, 236
Host, Intermediate Host, and Distribution, 236
T. mutans-type in
Antelopes: Accra, 281
Bovines: Russian Turkestan, 147
Goats: G.E. Africa, 146
T. ovis: Africa, &c., 147, 236
Host, Intermediate Host, and Distribution, 236
T. parva (*Piroplasma parvum*), of Bovines, 147, 231
Causal Agent of East Coast Fever in Cattle, 236

Piroplasmoses—*cont.*
THEILERIASIS—*cont.*
Parasites—*cont.*
Theileria—*cont.*
T. parva—*cont.*
Host, Intermediate Host, and Distribution, 236
Other Diseases due to, 236
T. rossica, of Rodents: Caucasus, 104
T. stordii, in Gazelle: Africa, 236
Host, Intermediate Host, and Distribution, 236

Plague, Bovine, *see* **Rinderpest**

Plague, Buffalo, or **Barbone** *see* **Barbone**

Plague-Control, 114

Plant-Poisoning; Recent Literature, 83

Pleuro-Pneumonia, Contagious
Bovine
Incidence, *see under* Bovine
Prophylaxis, 266–7
Statistics on Barotseland Epizootic, 267
Transmission by Traders, 266
Treatment by Glycerinated Virus, 267
of Goats
Incidence
British East Africa, 62, 66, 290
Italy, 55
Prophylaxis, 55, 289
Treatment by Inoculation, 55
Exudative form, 55
Incidence
Albania, &c., 55
British East Africa, 62, 66

Pneumonia, Contagious, or Septic, Equine
Bacteriology, 278–9
Economics, 278
in Equines, 212, 277–80
Nature, 278
Pathology, 279
Symptoms, 279

Protozoology, 1–27, 85–105, 141–71, 221–37
PROTOZOAN DISEASES, *see* **Amoebiasis; Anaplasmosis; Babesiasis; Coccidiosis; Leishmaniasis; Malaria, Avian; Nuttalliasis; Piroplasmosis; Spirochaetosis; Theileriasis; Toxoplasmosis; Trypanosomiases**

Protozoology—*cont.*
PROTOZOAN DISEASES—*cont.*
Halteridium Infection in Fowls, with Leucocytic Inclusions: Accra, 25–6, 60
In which Tartar Emetic is Efficacious, 24–5

PARASITES, *see also* Amoebae and Entamoebae, *under* **Amoebiasis**; Anaplasma, *under* **Anaplasmosis**; Babesia, Nuttallia, *and* Theileria, *under* **Piroplasmosis** and its sub-heads; Spirochaetes and Treponema, *under* **Spirochaetosis**; Trichomonas, *under* **Trichomoniasis**; *and* Trypanosomes, *under* **Trypanosomiases**
Binuclear Theory of Hartmann, basis of: Facts apparently Upsetting, 103
Kinetonucleus, Blepharoplast, and Parabasal body: questions of Nomenclature, 102–3
Pathogenicity; Development of, 26–7
Plate Culture Methods, 166 *et sqq.*
Achromaticus genus Characters, Classification, and Species, 236, *table*, 233
A. gibsoni, of Dogs: Madras, 236
Amoeba meleagridis, in supposed relation to *Eimeria avium*, 85
Binucleata, order, Invalidity of, postulated, 103
Coccidia, *see also* Eimeria, *infra*
Classification of, 231, 232
Haemosporidia allied to, 102
Coccidiomorpha, order, composition of, 231, 232
Crithidia, Ancestor of, 102
C. melophagia, of Sheep Louse, 167
Cultivation, 168
Morphology, 169
Dactylosoma genus; Characters and Classification, 237
Dermatococcus congolensis, in Equine Ulcerative Dermatitis: Belgian Congo, 46
Eimeria avium, of Sparrow, in relation to *Amoeba meleagridis*, 85
Elleipsisoma genus
Characters, Classification, and Species of, 237, *table*, 233
in Moles, 237

Protozoology—*cont.*
PARASITES—*cont.*
Endoglobular Parasite in Sparrows: Accra, 281
Endotrypanum genus
Characters and Classification of [França], 237
Species in Two-toed Sloth, 91
Flagellates
Kinetonucleus of, and Hartmann's Binuclear Theory, 102–3
Plate Cultivation of, 166 *et sqq.*
Grahamella, in
Dog: Accra, 60
Rodents
Accra, 283
Caucasus, 104
Nigeria, 71
Senegal, 144
G. ninae kohl-yakimovi, in Hamster: Caucasus, 104
Haemamoebidae genus
Characters, Classification, and Species, 232, 234, *table*, 233
Haematozoa
Connected with the Flagellata, 237
in Edentates: French Guiana, 91–2
Haemocystidium genus
Characters, Classification, and Species, 234, *table*, 233
in Snakes: Accra, 283
Haemocytozoa, *see* Haemosporidia, *infra*
Haemoflagellata; Haemosporidia not affiliated to, 103
Haemogregarina genus
Characters, Classification, and Species, 232, *table*, 233
Species, n
Crocodiles
Accra, 60
Nigeria, 71
Lizards
Accra, 60
French Guiana, 165
Snakes
Accra, 283
Nigeria, 71
Toads: Accra, 60, 283
Tortoises: Accra, 60
H. weinbergi, in Lizards: French Guiana, 165
Haemogregarinidae, fam.
Classification of, 232–4, *table*, 233
Haemoproteus genus
Characters, Classification, and Species, 234, *table*, 233
Species in Snakes, 234
H. columbae, of Pigeons, 234
H. danilewski (probable), in Sparrows: Accra, 281

Protozoology—*cont.*
PARASITES—*cont.*
Haemosporidia genus
Characters, Classification, and Species, 103, 231–7, *table*, 233
Sexual Phenomena, 231
Ha'teridium sp., in Turkeys, *see also* Haemoproteus, *supra*
Accra, 25–6, 60
Nigeria, 25
Hepatozoon genus
Characters, Classification, and Species, 232, *table*, 233
Herpetomonas
Ancestor of, 102
in Blood-sucking Flies: Nigeria, 70
in *Chamaeleon pumilus*: Robben Island, 27
Pathogenicity of, 26, 27
H. oestrum, of Oestrine Larvae, 110
Immanoplasma genus
Classification of, 237
Laverania genus
Characters, Classification, and Species, 234, *table*, 233
L. malarie (*Plasmodium falciparum*); Causal Agent of Tropical Malarial Fever, 234
Leptomonas
L. ctenocephali, of the Dog Flea, 167, 168
L. fasciculata, of Gnats; Cultivation of, 167
Leucocytogregarina
L. canis-like, in Dogs, &c.
India, &c., 165
Russian Turkestan, 164
L. musculi, in Mice
London, 105
Petrograd, 105
Turin, 105
L. ninae kohl-yakimovi, in Fish: Caucasus, 104
Leucocytozoon genus
Characters, Classification, and Species, 234, *table*, 233
Leucocytozoon of Birds: France, unnamed, 103
L. berestneffi, in Magpies: France, 104
L. piroplasmoides, in relation to Epizootic Lymphangitis, 40
L. ziemanni, in Owls: France, 104
Microsoma genus
Classification of, 237
collia genus
Characters and Classification of, 237

Protozoology—*cont.*
PARASITES—*cont.*
Nuttallia genus, *see also Nuttallia* sp., *under* **Piroplasmosis**, NUTTALLIASIS
Characters, Classification, and Species, 235, *table*, 233
Paraplasma genus
Characters, Classification, and Species, 236, *table*, 233
P. flavigenum
Bodies resembling, in Guinea-pigs, 25
Intermediate Host, 236
Pigmented, Intra-corpuscular, Unnamed, in Snake: Accra, 283
Pirhemocyton, or Pyrhemocyton genus
Classification of, 237
P. tarentolae, 105
Piroplasma genus, *see also under* **Piroplasmoses**, *supra*
Characters, Classification, and Species, 234–5, *table*, 233
Plasmodia
P. canis, of Dogs: Ceylon, 23
P. carinii, of Lizards: French Guiana, 105
P. praecox, of Lizards: West Africa, 105
Polymastix
Ancestor of, 102
Organelles in, 102
Proteosoma genus
Characters, Classification, and Species, 234, *table*, 233
Pigmentless, in Canary, 164
of Sparrows, 234
P. praecox, of Avian Malaria, 6
P. relictum, or Plasmodia, of Avian Malaria, 164
Pigmentless forms . . . in course of passage through Canaries, 163-4
Prowazekia
Ancestor, 102
Chromidial Body; Origin of, 102
P. cruzi, Kinetonucleus of, 102
P. lacertae, Kinetonucleus of, 102
P. ninae kohl-yakimovi, in Infusions of Hay, from Russia, 105
Rangelia genus
Characters, Classification, and Species, 263, *table*, 233
Rossiella genus
Characters, Classification, and Species, 236, *table*, 233
Smithia genus
Characters, Classification, and Species, 235, *table*, 233

Protozoology—*cont.*
PARASITES—*cont.*
Spirilla and Spirochaetes, Differentiation of, 143–4
Spirochaetes, *see also under* Spirochaetosis
in Blood-sucking Flies: Nigeria, 70
Classification of, by Bayon, 26
Classification, Sub-class, Order, and Sub-order of, 232
Haemosporidia (*q.v*), in relation to, 103, 231, 232
Theileria genus, *see also under* **Piroplasmoses**, THEILERIASIS
Characters, Classification and Species, 235–6, *table*, 233
Todd a genus
Classification of, 237
T. buffonis, Bodies resembling, in Snakes: Accra, 283
Toxopla ma genus, *see also under* **Toxoplasmosis**, *infra*
Characters, Classification, and Species, 237, *table*, 233
Toxoplasmodidae n.f.
Characters, Classification, and Species, 232, 237, *table*, 233
Trichonymphida
Parabasal bodies of, 102
Trypanoplasma
Organelles in, 102
Recent Literature, 77–8, 134–5, 214–15, 303–4

Quails, Mexican; Epithelioma contagiosum in, 48

Quarter Evil
in Bovines: B.E. Africa; Vaccine for, 290

Rabbits
Diseases of
Anaemia, Experimental, 4–5
Coccidiosis, Hepatic, 5
Mange, Auricular Psoroptic: Belgian Congo, 29
Toxoplasmosis: Brazil, &c., 237
Parasites of
Toxoplasma cuniculi, 237

Rabies
Animals affected by
Buffaloes: Italy, 191-2
Dogs
Immunity to, Heredity of; Experiments on, 118-20
Incidence
Assam, 283
B.E. Africa (Suspected), 290
Ceylon 212

Rabies—*cont.*
Animals affected by—*cont.*
Dogs—*cont.*
Incidence—*cont.*
India, 195
Italy, 195
Treatment by Vaccination; New Italian method, 195
Guinea-pigs, Experimental; Spasmodic Character of, 192–4
Virus of
Changes undergone by, in course of Transmssion through Guinea-pigs, 193–4
Passage of, through Oculo-Conjunctival Mucous Membrane, Healthy and Injured, 194–5

Rats
Diseases of
Mite Disease Experimental; Accra, 283
Myiasis, due to *Cordylobia murium*: German East Africa, 174
Parasites of
Grahamella
Incidence
Accra, 283
Caucasus, 104
Nigeria, 79
Senegal, 144
Leishmania tropica; Pathogenicity of, Experiments on, 89
Nuttallia decumani: Accra, 61, 144
Spirochaetes
S. eurygyrata-type: Accra, 93, 94
Trypanosomes
T. eburneense-type: Accra, 20–1
T. lewisi
Incidence
Accra, 21, 60, 61, 283
Morocco, 158
Nigeria, 71
T. lewisi-type, polymorphic: Accra, 20–1

Recurrent Fever
Parasite of
Spirochaete, 143

Red Dysentery, *see* **Coccidiosis, Bovine**

Redwater in Cattle, *see also under* **Piroplasmoses** (PABESIASIS), BOVINE
Differentiation of, from Anaplasmosis, and Gall-Sickness, 5

Redwater—*cont.*
Incidence
British East Africa, 64, 65
Great Britain, 235 *n.*
Rhodesia, 236
Parasite of
Piroplasma bigeminum, 235 *n.*
Treatment by Trypan Blue, 65

Recent Literature, 77–84, 134–40, 214–20, 298–304

Renguera, *see* **Paraplegia, Enzootic**, *supra*

Reports, 58–76, 211–13, 280–94
Accra Laboratory, 58, 280
Assam (1916–17), 283
Bihar & Orissa (1916–17), 284
British East Africa
Veterinary Department, 61, 285
Veterinary Pathologist (1915–16), 290
British Guiana, 211
Ceylon, 212
Gold Coast (1916), 291
Muktesar Laboratories, 66
Nigeria, 67
Paris, Veterinary Health Service of, and of the Department of the Seine, on Myocarditis and Foot-and-Mouth Disease, 197
Punjab: Camel Specialist, 71
Rhodesia, Southern, 212
Sleeping Sickness Commission of the Royal Society, Criticisms on, 150
Trinidad and Tobago (1916), 291
Uganda Protectorate, 75
Union of South Africa (1915–16), 291

Reptiles, *see* **Snakes**, *&c.*

Research Work, *see* **Reports**

Reviews of Books, 294–7
Camel, The, and its Diseases. Being Notes for Veterinary Surgeons and Commandants of Camel Corps (Cross), 296, 297
Leishmanioses. Kala Azar. Bouton d'Orient. Leishmaniose Americaine (Laveran), 294–6
"Tips" on Camels for Veterinary Surgeons on Active Service (Leese), 296–7

Rheumatism, Articular, in Camels: Punjab, 74

Rinderpest, 48–52, 120–8, 195–6
Animals affected by, *see* Bovines, Buffaloes, Bush Pig, Carabao, Cattle, Ovvines, Swine, *under* Names
in Animals other than Bovines: Assam, 283
Anti-Rinderpest Serum
Administration Technique, 266
Production and Tests of, 62, 64–5, 67, 120–2, 124, 125, 264–6, 290
Treatment by, 124–6
Bodies in Bovine Blood in: Eritrea, 195–6
Control of, 114
Differentiation of, from Anaplasmosis, and Babesiasis, 125
Eradication of: Bulgaria, 260
Goat-immunity to: Eritrea, 128
Incidence; All Animals
Abyssinia, 127
Asia Minor, 264, 266
Assam, 283, 284
Briti h East Africa, 62, 64, 65, 76, 127, 288
Bulgaria, 260, 264
Egypt, 123
Eritrea, 127–8, 195–6
German East Africa, 122 *et sqq.*
Gold Coast 291
India, 67, 285
Indo-China, 49
Nigeria, 67–9
Philippines, 48 *et sqq.*, 126
Somaliland, 127
Sumatra, 49
Turkey, 260, 263–6
Uganda, 75–6
Morbid Anatomy, 122–3, 266
Prophylaxis, 62, 75, 76, 114, 124–6, 260, 266, 288
Inoculation, 288
Double, 288
Anthrax developed after: B.E. Africa, 288
Isolation of Existing Centres, 127
Koch's Gall Immunisation, 125–6
Serum Stations
Bulgaria, 260
German Fast Africa, 124
Turkey, 264
Symptoms, 122–3, 266
Ulcers of Fourth Stomach, those of East Coast Fever resembling, 123
Transmission Experiments, 48 *et sqq.*, 73, 123
Treatment by
Serotherapy, 62, 64–5, 68, 212, 265, 283, 284
Sero-vaccination: Eritrea, Objections to, 127–8
Vaccine, 68

Rinderpest—*cont.*
Virus of
Preservation of, 67
Sheep and Goats as Carriers of, 123–4

Rodents, *see* **Guinea-Pigs, Mice, Rabbits, Rats**
Diseases of
Kiolo: Belgian Congo, 173
Myiasis, and Larvae causing
Incidence
Belgian Congo, in House dwellers, 173
Ivory Coast: Natural Infection by *Cordylobia murium* larvae, 174
Parasites of
Anaplasma: Caucasus, 104
Grahamella sp.
Incidence
Accra, 283
Caucasus, 104
Nigeria, 71
Senegal, 144
G. ninae kohl-yakimovi, 104
Leishmania
L. tropica, Pathogenicity of; Experiments on, 89, 90
Theileria
T. rossica: Caucasus, 104

Ruminants, *see* **Bovines, Caprines, Ovines**, *under* Names

Saurians, *see* **Crocodiles**, *and* **Lizards**

Scabies, Equine: U.S. Africa, 293

Scrapie, or Lumbar Prurigo, in Sheep: Great Britain, 275

Screech Owl
Parasite of
Trypanosoma syrnii, 169

Septicaemia of Swine: Ceylon; Possible Carrier of, 212

Septicaemia, Haemorrhagic
Bovine, in Buffaloes, Carabao, Cattle, *see under* each Animal
Camel-form, *see under* Camels
Equine, *see under* Equines
in Non-Bovines: Assam, 283
Incidence: All Animals
Assam, 283, 284
India, 73, 254, 285
Italy, 191–2
U.S.A., 189–90, 254
Organisms associated with 254
Specific Organism, 189, 190
as Used in Vaccine, 189

Septicaemia, Haemorrhagic—*cont.*
Post-Mortem Findings, 254
Prophylaxis
Inoculation, 285
Symptoms, 254
Treatment by
Serotherapy, 68, 283, 284
Vaccine, 68
Virus Preservation, 67

Serological Works, *see* **Reports**

Sesheke Sickness, *see under* **Trypanosomiases**

Sheep, *and* **Lambs**
Diseases of
Anaemia; Experimental, 4–5
Anaphylaxis, induced by Larvae of *Hypoderma bovis*, *H. lineatum*, and *Oestrus ovis*, 109–10
Anaplasmosis: Sardinia, &c., 3–5
Anthrax; Ceylon and India, 212
Babesiasis, *see* Piroplasmosis, *infra*
Blue-Tongue: Union of South Africa, 293, 294
Fasciola hepatica Invasion, *see* Sheep-Rot, *infra*
Foot-Rot, Contagious; British East Africa, 290
Gastro-Enteritis, Verminous; British East Africa, 290
Geel-Dikkop; U.S. Africa, 293–4
Helminthiases: B.E. Africa, 63, 64
Louping-ill: British Isles, 275
Nairobi Sheep Disease, 66, 128–32, 290
Oestophagostomum columbianum Infection: B.E. Africa, 64
Paralysis: Tick-spread
Incidence
British Columbia, 275
Cape Colony, 275
Paraplegia, Enzootic or Renguera: Peru, 269–77
Pataleta; Argentina, 270
Piroplasmosis (or Babesiasis), and Theileriasis
Incidence
Accra, 59
German East Africa, 186
Italy, 235
Nigeria, 69
Roumania, 235
Russian Turkestan, 146, 147
Transcaucasus, 235
Turkey, 235
with Theileria: Russian Turkestan, 146
Psoroptic Otacariasis: Belgian Congo, 29
Rinderpest: Egypt, 123

Sheep—*cont.*
Diseases of—*cont.*
Scrapie, or Lumbar Prurigo: Great Britain, 275
Sheep-Pox
Incidence
Bulgaria, 260, 261–3
Germany, 261
Russia, 261
Sheep-Rot
Incidence
Peru, 275
Sardinia, 3–4
Parasite
Fasciola hepatica, 3, 275
Sheep-Scab: British East Africa, 62
Strongyloidosis; Method of Infection by *Haemonchus contortus*, 34–5
Wireworm Infection: British East Africa, 63
Swingback: Great Britain, 275
Trypanosomiasis
Incidence
Accra, 59
Nigeria, 70
Senegal, 17
White-Liver, U.S. Africa, 294
Insects Injurious to
Australia, 177–8
British Guiana, 180
Peru, 272
Zanzibar, 179
Melophagus ovinus, *see under* Entomology
Parasites of
Helminths
Incidence
British East Africa, 64
Italy (Sardinia), 3–4
Peru, 275–6
Union of South Africa, 34–5
Cysticerca tenuicollis, 276
Dictyocaulus filaria, 275
Fasciola hepatica, 3–4, 275
Haemonchus contortus, 34–5, 276
Monezia expansa, 276
Oestophogostomum
O. columbianum, 64
O. radiatum, 276
Tricocephalus affinis, 275
Piroplasma
P. ovis, 237
Spirochaetes
S. eurygyrata-type: Accra, 93, 94
Theileria
T. ovis, 236, 247

Sheep-Pox
Incidence
Bulgaria, 260, 261–3
Germany, 261
Russia, 261

Sheep-Pox—*cont.*
Prophylaxis
Isolation, 262
Vaccination, 261, 262–3
Technique, 262–3
Symptoms, 261–2

Sheep-Rot, *see under* **Helminthiasis**

Sheep-Scab: British East Africa, 62

Shrew Mice
Parasites of
Anaplasma
A. marginale: Dakar, 144
Grahamella: Dakar, 144
Spirochaete, new
S. crocidurae: Dakar, 144

Shipping Fever of Cattle; U.S.A., 190

Sloths
Three-toed: French Guiana
Parasite of
Haematozoon, 91–2
Two-toed: French Guiana
Parasites of
Endotrypanum, 91
Trypanosome, 91

Snakes
Parasites of
Haemocystidium: Accra, 283
Haemogregarines: Accra, 283
Haemoproteus, 234
Pigmented Intracorpuscular (unnamed), 283
Trypanosome (unnamed): Accra, 283
Red corpuscles in Blood, resembling *Toddia buffonis*, 283

Snipe, Microfilaria of: Senegal, 106-7

Sore Throat, in Camels: Punjab; Treatment, 73

Sparrows
Diseases of
Coccidiosis, in relation to Blackhead in Turkeys, 85–6
Parasites of
Coccidia
Eimeria avium, 85
Endoglobular: Accra, 281
Haemoproteus danilewski (probable): Accra, 281
Proteosoma, 234

Spirillosis, at present not known to exist, 143, 144

Spirochaetoses, 7–8, 92–6, 142-5; *see* **Icterohaemorrhagica, Recurrent Fever, Tick Fever**
Avian, in Fowls: Senegal, 142–3
Causal Agent: Symptoms, 142–3
Insect Vectors of, 143
Parasites associated with
Spirilla and Spirochaetes, relations between, 143–4
Spirochaetes and Treponema
in Dogs, in Experimental Trypanosomiasis: Sudan, 94
List of those seen in Healthy and Diseased Animals, 145
of Man and other Animals; Morphology of, Identification by Length, 92-3
Pathogenic, 27
Saprophytic, in Fundus of Dog's Stomach, 95–6
Secondary Invasion by, 145
in White Rat, Experimentally infected with Streptococcal Culture, 144–5
S. canis (n. sp.), in Dogs and Cats: Accra, 93–4
S. crocidurae, n. sp., of Shrew-mouse: Dakar, 144
S. eurygyrata-type, in Various Animals: Accra, 93–4
S. gallinarum, 142
S. marchouxi, in Domestic Fowls: Accra, 281
S. neveuxi, in Fowls: Senegal, 142
S. regaudi, in Stomachs of Dogs and Cats, 96
S. refringens, Drug-fastness of: Tests of, 95
Unnamed, in Stomachs of Dogs and Cats, 96
Treponema
Drug-fastness of, to Arsenic, Mercurial, and Iodide Compounds *in vitro*, 98–9
T. microdentium, Drug-fastness of: Tests of, 95
T. pallidum, Drug-fastness of: Tests of, 94, 95
T. pallidum-type, in Dogs, 94
Recent Literature, 78, 135, 214, 298
Swine Fever associated with, 7–8, 146
Transmission by Arthropods: Syphilis the one exception, 143

Sporotrichosis, 43–5
Equine: Montana, 44–5

Sporotrichosis—*cont.*
Parasite
Sporothrix
S. schenki-beurmanni, Blastomycotic Form of, 44–5
Feeding Experiments with, 44
Penetration by, of Gastro-Intestinal Wall, 43–4

Stockyard Fever, U.S.A., 190

Stomatitis, Pustular (or Vesicular), Contagious
Animals affected by
Cattle, 204–6
Equines, 201–6
Bacteriology, 203 *et sqq.*
Causal Organisms, 203, 204
Clinical Features, 208–9
Differentiation of, from Foot-and-Mouth Disease, 205, 206
Experimental, 208–9
Transmission Experiments, 202
Incidence: All Animals
England, 200
France, 200–1, 206
Germany, 201
Holland, 201
Hungary, 204
Italy, 204
U.S.A., 203
Relation of, to Equine Variola and Vaccinia, 200 *et sqq.*
Symptoms, 201–2, 205–6, 208
Treatment, 206, 207–8

Strangles, in Equines
Incidence
British East Africa, 290
India, 67
South Africa, 290
Trinidad, 291
Treatment by
Anti-serum, 67
Vaccines, 67

Summer Sores, in Equines, *see* **Dermatitis, Granular, Equine,** *under* **Helminthiasis**

Surra, *see under* **Trypanosomiases**

Swamp Fever, *see* **Anaemia, Infectious, of Equines**

Swine, or Pigs, *see also* **Bush Pigs**
Diseases of
Babesiasis, *see* Piroplasmosis, *infra*
East African Swine Fever (suspected): British East Africa, 290
Mange, Sarcoptic; Transmissible to Man, 27

Swine—*cont.*
Diseases of—*cont.*
Piro lasmos s; Accra, 59, 60
Rinderpest: Philippines and elsewhere, 48 *et sqq.*
Septicaemia: Ceylon; Possible Carrier of, 212
Swine Fever, 145
Immunity to, of Uganda Bush Pig, 66
Incidence
British East Africa, 62
Philippines, 52
Russia, 7–8
Prophylaxis, 62
Relation of, to other Spirochaetoses, 7–8, 146
Trypanosomiasis
Incidence
Accra, 59
Belgian Congo, 97
Nigeria, 70, 71
Principe, 27, 97
Healthy; Bacteria of the Typhocoli group in, and Differentiation of the Paratyphoid B. group in, 188–9
Imported, Breeding Experiments with: Ceylon, 212
Insects Infesting
Africa, 110
Belgian Congo, 27–8, 29
British Guiana, 181
Parasites of
Moniezia expansa: B. Guiana, 180
Piroplasma
P. ovis, 90
Spirochaetes
S. eurygyrata-type: Accra, 93,94
Rôle of, in Maintenance of Human Ectoparasites, 27–8

Swine Fever
Incidence
British East Africa, 62
Philippines, 52
Russia, 7–8
Spirochaetes in Blood in, in relation to the Disease, 7–8,145
Spread by Wild Porcines, 62

Swingback, in Sheep: Great Britain, 275

Taenasis, *see under* **Helminthiasis**

Theileriasis, *see under* **Piroplasmoses**

Three-Days Sickness, *see* **Ephemeral Fever**

Tick-Borne Diseases, *see* **Anaplasmosis; East Coast Fever; Nuttalliasis; Paralysis; Piroplasmosis; Redwater; Theileriasis**

Tick Fever
Due to Spirochaetes; *Ornithodorus moubata*, Vector of, Hosts of, 27

Ticks, *see under* **Entomology**

Toads
as Hosts of *Margaropus annulatus* var *australis*: British Guiana, 181
Parasites of: Accra, 283
Haemogregarine (Unnamed), 60 283
Toddia buffonis, 283
Trypanosoma rotatorium, 60, 283

Tortoises
Parasites of
Haemoproteus, 234

Toxoplasmosis
Canine
Incidence
Brazil, 237
Germany, 237
Italy, 237
Tunis, 165
of Gondis: Tunis, 165
of Rabbits: Brazil, &c., 237
Parasites of
Toxoplasma
T. canis, 237
T. cuniculi, 237
T. pyrogenes; Pathogenic to Man: India, &c., 237

Trichomoniasis
in Turkeys, 87–8
Parasites associated with
Trichomonas
Ancestor, 102
in Leeches: Turkestan, 165–6
Penetration by, in Blackhead of Turkeys, 87, 88
Recent Literature, 78

Trypanosomiases, 8–24, 96–103, 148–63, 221–9; for Incidence of Different Forms, *see under* Animals affected; for Incidence, All Forms, *see infra*
Anaphylaxis; Causation; Investigation of Trypanosome Anaphylatoxins, 158-60

Trypanosomiases—*cont.*
Blood Conditions in: Agglutination, Disagglutination and Pseudo - Agglutination of Red Corpuscles during, 160–3

BOVINE
Prophylaxis
Segregation of Fly-struck Animals, 222
Transmission by Flies, other than Glossina, 221–2, 223, 253

CAMEL
Distribution and Causes: Africa, 253, 257
Season and Humidity in relation to: Eritrea, 257

CANINE, 17, 60, 70, 281

CAPRINE, in French West Africa, 17

Chemotherapy, *see also* Treatment, *infra*
Luargol: Biological Tests of, 154
Salvarsan: Toxicity of, relative to that of Luargol, 154
Trypanocidal Action of Certain Drugs, 156

DEBAB: Camel-form Indistinguishable from, 253

Diagnosis by
Agglutination – Disagglutination, 163
Conglutination Method, 155
Serological Method: Technique, 19–20

DOURINE
Diagnosis by
Conglutination Method, 155
Serological Tests, 19–20
Experimental, in Mice: Action in, of Luargol, 154
Incidence
America, U.S.; States affected, 191
Trypanosome of, Anaphylatoxin-production Experiments with, 159

EQUINE, 12, 17, 60, 70, 96–7, 181, 282, 283, 284
Trypanosoma marocanum of; Experiments with, on Various Animals, 96–7

EXPERIMENTAL
Action in, of Emetine, on *T. equiperdum*, 101–2

Trypanosomiases—*cont.*
EXPERIMENTAL—*cont.*
Blood Platelet Test of Immunity in: Technique 99–100
Canine; Spirochaetes in, 94
Equine, Moroccan form, 96–7
in Frogs, 170–1
Lyperosia exigua, in relation to, 13
Numeric relation of Infection to Chemotherapy of, 98–9
Recurrent Infections in: Tests: Results, 100–1

Flies Experimented on, as Carriers, 11 *et sqq.*
Forms met in British East Africa, 63
Game Animals in relation to, 16, 113, 150, 152
Glossina associated with, *see under* **Entomology**
Incidence
Geographical: All Forms
Accra, 59
Assam, 283
Barotseland, 221
Belgian Congo, 21
British East Africa, 63
Central Africa, 148, 149
Ceylon, 212
Dutch East Indies, 223, 229
Eritrea, 253
French West Africa, 17
German East Africa, 149
India, 11, 12, 72, 74, 75, 284
Malaya, 11
Mauritius, 12
Morocco, 96–7, 253
Nigeria, 69, 70–1, 74–5
Nyasaland, 148, 149, 150–2
Philippines, 11–12
Portuguese East Africa, 148, 149, 221
Principe, 27, 97
Rhodesia, 148–9, 150, 152, 221-2, 222–3
Senegal, 15
Sudan, 149
Uganda, 76
Union of South Africa, 293
Upper Gambia, 17
Season, 221, 225

MAL DE CADERAS, in Equines, 159, 181
Fly-spread: British Guiana, 181

MBORI, Camel Trypanosomiasis indistinguishable from, 253

MIXED INFECTIONS
Experiments on: 152–4
Natural, 154

Trypanosomiases—*cont.*
NAGANA
Inoculation Experiments, 9–10
Mixed Infection Experiments, 153
Mouse-kind; Experimental; New Immunity Reaction in, 99–100
Trypanosome of, 159

OVINE in, Nigeria, 70

PORCINE, in
Accra, 59
Belgian Congo, 97
Nigeria, 70
Principe, 27, 97
Human, in relation to, 27, 97

Prophylaxis, 12, 18, 150, 152, 289
Suggested Control-Measures, 114
Recent Literature, 77, 78, 136, 215

SESHEKE SICKNESS: N. Rhodesia; Trypanosome causing, 222

SURRA, 159
Animals affected
Buffaloes: Dutch East Indies, 223–5, 229
Effect on Females, 224
Feeding in relation to, 223, 224, 225
Post-mortem Findings, 224
Prognosis, 224, 229
Prophylaxis, 224, 225
Symptoms, 223–4
Camels: India, 72
Age in relation to
Course, and Death, 74
Immunity, 75
Infectivity to Ponies, 75
Treatment by
Arsenic, 73
with Soamin, 73
Drugs found Ineffective, 63
Holmes's Method, 63
Cattle: Mauritius, 12
Carabao: Philippines, 12
Equines, 12, 74, 75, 225, 283, 284
Seasonal Incidence, 225
Differentiation of, from Nagana, 8
Incidence
Geographical
Assam, 283
British East Africa, 63
Ceylon, 212
Dutch East Indies, 223–5, 229
India, 11, 12, 74, 75, 284
Malaya, 11
Mauritius, 12
Morocco, 96–7, 253
Nigeria, 74–5
Philippines, 11–12
Season, 225

Trypanosomiases—*cont.*
SURRA—*cont.*
Insect Vectors, 10 *et sqq.*, 67, 75
Prophylaxis, 12
Transmission Experiments, 75, 111–12
Trypanosomes of
Harboured by Mosquitoes, 12, 13
T. evansi; Transmission Experiment with *Lyperosia exigua*, 13

Transmission by
Glossina, *see* Glossina, *under* **Entomology**
Insects, other than Glossina, 113, 148–51, 181, 221–2, 253, 289
Experiments on, 111–12
Swine, 27, 97
Treatment by
Sodium Protosonate, 212
Tartar Emetic, 21 *et sqq.*
Modes of Administration, 23–5
Vaccine, 71
Trypanosome Anaphylatoxin; Experiments on, 158–60
Trypanosome and other Infections in Glossina, 18–19

TRYPANOSOMES
Action on, of
Emetine Hydrochloride, 101–2
Normal Human Serum, 171
Tartar Emetic, 21, 23
Various Chemical Compounds and Drugs
Determination Methods, 98–9
Experiments on, 156
Ancestral Flagellate from which Evolved, 102
Arsenic-resistance of, 94–5
Carried by various Glossina, 70, 151, 228, 229
Classification and Transmission of, 148–50
Cross-Immunity Tests, 151
Drug-fast; Production of, 94, 101
Kinetonucleus of, 102
Mathematical Analysis of, 151
Mazagan Trypanosome, Pathogenicity of, Experiments on, 156–8
Monomorphic, from Man: Gold Coast, 225 *et sqq.*
Table of Lengths, 226
Morphology, 150
Pathogenicity Researches, 26, 151
Plate Cultivation of, 169–71
Polymorphic, in
Antelope: Accra, 281
Rat, 20–1
Present in Buffaloes with Anaplasmosis: Java, 229

Trypanosomiases—*cont.*
TRYPANOSOMES—*cont.*
Schizotrypanum cruzi (*T. cruzi* of Chagas), Cultivation of, 171
of Sheep: Stages in Development of, 169
Transmission, 148–51
by Glossina, 70, 151, 228, 229
by Insects other than Glossina, 15, 113, 148–51, 181, 215 *et sqq.*, 221–3, 253, 257
Experiments on, 111–12
T. brucei, 7. 9, 19, 23, 26, 90, 100-1, 150–2, 154, 155, 159
T. brucei (*pecaudi*), 19
T. brucei vel *rhodesiense*, Inoculation Experiment with, 149
T. caprae, 228, 229
T. cazalboui, 17, 21, 23
T. congolense, 19, 21, 23, 59, 60, 97, 282
T. congolense (*pecorum*), *see T. pecorum, infra*
T. dimorphon, 17, 154, 223
Mixed Infection with, 154
T. duttoni, 158
T. cruzi, 171
T. eburneense-type, 20
T. equinum, 23, 159
T. equiperdum, 23, 60, 98–9, 101–2, 159
T. evansi, 13, 23, 152, 159, 215 *et sqq.*, 223, 224
T. gambiense, 10, 23, 90, 142, 151, 223, 281
T. grayi-type, 18, 113–14
T. lewisi, 26, 60, 61, 158, 159, 283
T. lewisi-type, 21
T. longocaudense, 21
T. pecaudi, 17, 59, 70–1 (probable), 282
or *T. gambiense*, 281
T. pecorum, 10–11, 70, 71, 148–9, 178
or *T. gambiense*, 11, 153, 154
T. pecorum group, Infection; Transmission in absence of Glossina, 221-2
T. pecorum-type; Transmission of, otherwise than by Glossina, 113
T. rhodesiense, 171, 223
T. brucei in relation to, 7–9
T. rotatorium, 60, 169–71, 283
T. soudanense, 152
T. syrnii, 169
T. theileri, 15, 169, 293
T. ugandae, 9, 21
T. unnamed
Accra, 283
in Edentates: French Guiana, 91
in Snake: Nigeria, 203

Trypanosomiases—*cont.*
TRYPANOSOMES—*cont.*
T. uniforme, 228, 229
T. vivax, 19, 59, 228, 229, 282
Lengths and Distribution, 226-8
Table, 227
Mixed Infection with, 154
Possible Pathogenicity of, to Man, 229
T. vivax-like Monomorphic Trypanosome of Man: Gold Coast, 225 *et sqq.*
Length: *Table*, 226
T. vivax-type, 70, 71

Tuberculosis
Animals affected by
Bovines
Incidence, *see under* Bovines
Treatment, 292–3
Tuberculin Test for, 292
Camels
Bacillus of Bovine type present in: Egypt, 117, 118
Incidence, *see under* Camels
Post-mortem Findings and Symptoms, 117–18
Tuberculin Test for, and Normal Healthy Temperatures, 118

Tumours, Warty, in Zebu: Belgian Congo, 133

Turkeys
Diseases of
Blackhead, 85–9
Incidence
Canada, 85
U.S.A., 85–8
Halteridium-like Infection
Incidence
Accra, 25–6, 60
Nigeria, 25
Leucocyte-Inclusion in, 25–6, 60
Trichomoniasis, 87–8

Turtles
Parasites of
Haemogregarines: Nigeria, 71

Ulcerative Lymphangitis, *see* **Cellulitis, Ulcerative,** *and* **Lymphangitis, Ulcerative**

Ultra-Visible Viruses, *see* **Filterable Viruses**

Vaccinia
Relation between, and Equine Contagious Pustular Stomatitis, 200 *et sqq.*
and Variola, Researches on, 132

Vaccine Lymph, Safety Tests of: Nigeria, 71

Vaccines; Preparation of: Nairobi Laboratory (1914–15), 63

Variola
and Vaccinia, Researches on, 132
Equine
Relation between, and Equine Contagious Pustular Stomatitis, 200 *et sqq.*
Recent Literature, 81
Vaccinia, Generalised, Experimental, 53, 54

Vesicular Stomatitis, *see* **Stomatitis, Contagious Pustular**

Veterinary Service
Bulgaria, 260
Turkey, 264

Waii, in Camels: Punjab, 74

Wart Hogs
Ectoparasites of, Transmissible to Man, 27 *& n.*

White Liver, in Sheep: Union of South Africa, 294

White-Throat, Large, Microfilaria of: Senegal, 107

Wireworm, *see under Haemonchus*, *under* **Helminthiasis**, *see also* Wireworm, *same place*

Wolves
Diseases of
Piroplasmosis: Russian Turkestan, 146
Parasite of
P. canis-type, 146

Worm Nodules, *see* ONCHOCERCIASIS, *under* **Helminthiasis**

Zebu Cattle
Diseases of
Onchocerciasis: Australia, 252
Tumours: Belgian Congo, 133

CONTENTS.

DISEASES DUE TO PROTOZOAN PARASITES.

PAGE.

JACK; CHAMBERS: Transmission of Trypanosomiasis in Rhodesia 221–222

DOEVE: Surra in Buffaloes in the Dutch Indies.. 223

MACFIE: A Monomorphic Trypanosome of Man.. 225

BRUGGEMAN: Anaplasmosis in Buffaloes.. 229

PRICOLO: Classification of Piroplasmoses in Tunis 230

STEFKO: Piroplasmosis in Turkey.. 231

FRANÇA: Classification of Haemosporidia 231

DISEASES DUE TO METAZOAN PARASITES.

WIRTH: Filariasis in Hungarian Horses (Plates) 237

VAN SACEGHEM: Granular Dermatitis of Equines 248

DICKINSON & HILL: Worm Nodules in Cattle 250

CONREUR & URBAIN: Haemorrhagic Enteritis of Puppies .. 252

FERRARO: Blood-Sucking Flies of Eritrea and Trypanosomiasis 253

BACTERIAL DISEASES.

HARDENBERGH & BOERNER: Haemorrhagic Septicemia in Mules 254

WATSON: Ulcerative Cellulitis—Ulcerous Lymphangitis .. 255

DISEASES DUE TO FILTERABLE VIRUSES.

SOHNS & SOETEDJO: Equine Infectious Anaemia 257

NEVERMANN, MIESSNER & WEICHEL: Travel Studies in the Balkans 260

BROGAN: Contagious Bovine Pleuro-Pneumonia in Northern Rhodesia 266

MISCELLANEOUS.

HADWEN: Bovine Haematuria 267

TABUSSO: Enzootic Paraplegia in Lambs 269

GAIGER: Renguera: A Paralytic Sheep Disease in Peru (Fig.) .. 273

WATKINS-PITCHFORD: Septic or Contagious Pneumonia in Horses 277

CONTENTS—*continued.*

REPORTS.

	PAGE.
GOLD COAST: Report of Accra Laboratory for 1916	280
ASSAM: Civil Veterinary Department, 1916–17	283
BIHAR & ORISSA: Civil Veterinary Department, 1916–17 ..	284
BRITISH EAST AFRICA: Civil Veterinary Department for 1915–16	285
BRITISH EAST AFRICA: Report of the Veterinary Pathologist, 1915–16	290
GOLD COAST: Veterinary Department for the Year 1916 ..	291
TRINIDAD & TOBAGO: Government Veterinary Surgeon's Report, 1916	291
UNION OF SOUTH AFRICA: Report of the Veterinary Division, 1915–16	291

BOOK REVIEWS.

LAVERAN: Leishmanioses. Kala-azar. Bouton d'Orient. Leishmaniose Américaine	294
LEESE: "Tips" on Camels	296
CROSS: The Camel and its Diseases	296

RECENT LITERATURE	298–304