

Undulant fever in South Africa / by P. D. Strachan.

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Undulant Fever

IN

SOUTH AFRICA

BY

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1906.

months there was a sharp epidemic of true typhoid fever in the camp. Among the cases of typhoid fever there were many in which the fever was prolonged and irregular, and these were seldom fatal. Nevertheless, among these the characteristic complications and sequelæ of Undulant fever were so rare that one would not be justified in placing them as a whole in the latter category. Undulant fever was not thought of at the time, but I feel justified in retrospectively diagnosing six cases as Undulant fever. Five were in one family. These were returned again and again to the hospital for many months suffering from what appeared to be a relapsing fever with neuritis. The remaining case was that of a middle aged man who was laid up in his tent for several months with lumbago and sciatica, and an irregular low fever. I have recently tested three sera from cases of prolonged irregular fever in three separate districts of Cape Colony. These gave marked positive reactions with the *b. typhosus*, negative with the *m. melitensis*. It seems therefore probable that most of the cases of this type which occurred, at least in my practice, during the war were cases of typhoid or paratyphoid infection. On the other hand it must be noted that many cases of Undulant fever are symptomless (with the exception of the pyrexia) throughout. It would therefore seem to be almost impossible to diagnose such cases with certainty without the agglutination test, where typhoid and Undulant fever are endemic together.

In the end of August, 1902, I began to practise in the town and district of Philippolis. In October, 1902, I came across the first case of Undulant fever, and diagnosed it "Typhoid." This case was the most prolonged in my experience, the pyrexia lasting with intermissions for two years (3). None of the more characteristic complications and sequelæ of Undulant fever occurred in this case. A daughter (3) of this patient suffered from a continued fever in January and February of 1904. In her case there was effusion into one ankle joint towards the end of the illness. Towards the end of 1903 it was noted that a considerable proportion of the cases presented the characteristics of Undulant fever, and in the beginning of 1904 a paper was read before the O.R.C. Medical Society, recording seventy-two cases which I believed to be cases of Undulant fever. In March, 1904, blood samples from six typical cases were tested for typhoid fever by Dr.

Edington at Grahamstown, reaction negative. Since that date the sera of nearly all fresh cases of Undulant and typhoid fever, as well as sera from many cases that had recovered, have been tested by Dr. Edington, Dr. G. W. Robertson, Lieut.-Colonel C. Birt, Captain Buist and myself. Most of the results thus obtained have been already published by (4) Lieut.-Colonel Birt and myself. They will be summarised in another portion of this paper.

During the past four years 138 cases of Undulant fever and 30 cases of typhoid have occurred in my practice. The disparity between the numbers is striking because its sign is the reverse of what might have been expected in South Africa, where the endemicity of typhoid is regarded as a serious problem, while the presence of Undulant fever has received little attention until recently.

The following is a statement of the number of the cases of Undulant and typhoid fever which were observed in the District of Philippolis during each of the past four years:—

	Undulant F.	Typhoid F.
Sept. 1902—03	17	13
„ 1903—04	75	10
„ 1904—05	21	4
„ 1905—06	25	3
	— —	— —
Total	138	30

The seasonal distribution of the two fevers has been as described in a former paper, (5) viz.:—Fresh cases of Undulant fever are generally met with during the spring and early summer months, *i.e.*, September—January. Cases of typhoid fever have generally occurred in the late summer and autumn months, *i.e.*, January—April.

To my former statements (5) regarding the age and sex incidence nothing need be added except that Undulant fever appears to occur not infrequently in the very young. Two patients, at 3, and one at $2\frac{1}{2}$ were among the number of the sufferers. The serum of the last gave a positive reaction in my hands, and the reaction was confirmed by Lt.-Colonel Birt.

Before the writing of this paper was undertaken, it was hoped that a clinical comparison between Undulant fever in South Africa and in the Mediterranean might be made. I regret to say that I have been unable to lay

hands upon the classical work of Hughes, which is out of print. Lt.-Colonel Birt, however, has kindly supplied me with some notes from Hughes. The actual and percentage numbers of what appeared to be leading symptoms, complications and sequelæ have been worked out in the above 138 cases. Doubtless the value of such statistics is considerably impaired by the smallness of the number of cases.

Number of cases=138.

Continued fever in every case.

Lumbago	...	...	87	percentage=	63
Other neuralgiæ	...	...	6	"	4.3
Paraplegia	...	...	4	"	2.9
Joint Effusions	...	...	27	"	19.5
Pulmonary complications	...	...	26	"	19
Orchites	...	...	8	"	5.8
If females are not counted					9.4
Severe Typhoid State	...	...	12	percentage	8.7
Symptomless	...	...	30	"	21.7
Gastro-intestinal disturbance	...	...	6	"	4.3
Deafness	...	...	3	"	2.17
Obstinate Epistaxis	...	...	1	"	0.7
Endocarditis	...	...	2	"	1.4
Cold Lumbar abscess (post febrile)	...	...	3	"	2.17
Acute Nephritis	...	...	1	"	0.7
Intracranial Disease	...	...	2	"	1.4
Enlarged Liver	...	...	3	"	3.6
Enlarged Spleen	...	...	4	"	2.9

A few remarks may now be made upon the above statistics :—

The percentage of joint effusions seems lower than one would expect, considering the prominence given to this complication in the usual descriptions of Undulant fever. Hughes has put them at some 40 per cent. In only three cases were the joint effusions multiple. The joints affected were in order of frequency the knee (13), ankle (9), wrist (4), elbow (3). Joint effusions were most common in children and young adults.

In the four cases recorded, paraplegia followed very severe neuralgia, and affected the legs below the knee. The extensors of the feet were most severely affected, and were the last set of muscles to recover. The patellar tendon reflexes were for a time abolished. There

was no ankle clonus. Pulmonary complications took the forms of bronchitis and atypical pneumonia. The typhoid state was found only in association with severe pulmonary complications.

Orchitis occurred only in adults. Hughes has put the percentage incidence of orchitis at 4 or 5, but I am not aware whether females were counted or not.

The symptomless cases were for the most part ambulatory.

Although constipation was the rule, it did not, when properly dealt with, lead to troublesome gastro-intestinal disturbances.

The three cases of deafness were associated with a severe typhoid state.

Sweating was a prominent symptom in many of the cases, but in the majority it was not seriously complained of. It may be suggested here that in countries where the atmosphere is exceedingly dry, perspiration tends to become less sensible and at the same time more efficient as a heat regulator.

Acute nephritis and endocarditis have been noted among Mediterranean cases. Bassett Smith (6) has recently recorded cases of the latter. According to Hughes, renal disease is a serious complication in some prolonged cases.

Intracranial disease, in the two cases recorded above, was post-febrile. Such complications must be regarded as the gravest possible. It seems well to give notes on the two cases:—

Case I. A child, *æt.* 9, living at a distance of 27 miles from Philippolis, and convalescent from Undulant fever, developed symptoms of meningitis. About ten days after a diagnosis of meningitis had been made, the child was seen again. It was reported by the parents that after a copious discharge of pus from the nose the child began to recover. On this occasion both pupils were dilated, and there was at least object blindness. Objects shewn could not be named until they had been handled. There was some mental obtuseness, which made it difficult to ascertain whether there was any kind of visual sense left. The fundus presented a normal appearance in both eyes. Perfect vision was restored in about two months.

Case II. A man, *æt.* 38, presented himself on the 22nd September, suffering from constant headache and partial paralysis of the left leg. He gave a history pointing to Undulant fever in May, 1904. His two

brothers with their families living on the same farm, had had the disease some months previously. His serum was tested by Dr. Edington against the *micrococcus melitensis* in a dilution of 1—50, and gave a positive reaction. He was seen at his farm on three occasions subsequently by Dr. D. M. Macrae and myself. On the occasion on which I saw him last, there was complete left hemiplegia, and both pupils were dilated. A view of the fundus could not be obtained, because the patient, owing to intense headache, was unable to keep his head still. A diagnosis of intracranial tension from abscess or tumour was made. He died on the 6th October. Operation and post-mortem examination were refused. Possibly this was a case such as Hughes describes, page 124, case 15, of which the following are notes, — (7)

“Cerebro-spinal irritation with fatal intracranial pressure—High fever 25 days, then delusions for four days—‘Rheumatic’ pains nerves of legs—Remittent fever till 45th day, then intermittent. Exacerbation 102nd day—Mentally irritable—Sleepless—Shooting pains in head. 112th day headache very severe, reflexes exaggerated, hyperæsthesia, rambled in conversation. 113th day unconscious for most part. 115th day blind left eye, left pupil enlarged, ptosis and divergent strabismus. 116th day coma deepened—died—no past syphilis. P.M. Brain much congested, soft and œdematous at base. Excess of cerebro-spinal fluid—Lymph on choroid plexus. *Micrococcus melitensis* from brain.”

A third cerebral case very similar to the above has not been inserted in the above statistics, because at the time of framing them I believed that the condition was not secondary to Undulant fever. Before death this case passed into the hands of a medical practitioner in another part of South Africa, who attributed the fatal issue to arterio-sclerosis, which I had failed to observe. Lieut.-Colonel Birt, on receiving notes of the case from me, expressed the opinion that death was due to *micrococcus melitensis* meningitis, and furnished me with the above notes from Hughes.

It is a remarkable fact that enlargement of the spleen was detected in only four cases. Perhaps this was due to the incompetency of the diagnostician. Even in Typhoid fever I have in the majority of cases, failed to detect enlargement of the spleen. This condition receives so much prominence in classical descriptions of both Undulant fever and Typhoid fever that I have grave doubts as to my own ability to exclude enlargement of

the spleen. When a positive conclusion has been come to, one is usually on safer ground.

The appearance of the tongue is worthy of remark. During the first few weeks of fever it was generally clean and red at the edges and tip, and elsewhere covered with a light silvery fur. In the worst cases it was thickly coated with white, large and flabby, shewing indentations. In only one case, in which pneumonia was present, was the coating brown. In the vast majority of the cases the tongue was clean and red during the later and greater period of the illness. In a few, although clean and red, it was dry, shining and cracked.

Children seemed to suffer least, notwithstanding that in them the pyrexia was most acute. One girl, *æt.* 10, was seen four times in succession at intervals of a week. On these occasions the temperature ranged between 103° and 105°. Nevertheless the tongue was clean, red, and moist, the appetite was good, and nothing was complained of except the hardship of being kept in bed. A boy, *æt.* 11, was found going about with an evening temperature of 104°. In this case there was slight lameness from pain in one hip.

The character of the pyrexia corresponded in all respects to that usually described in the literature of Mediterranean fever. Among the few continuous charts which one was enabled to obtain, some shew distinct undulations, others are extremely irregular. The pyrexia varied in duration from a few weeks (in children) to eighteen months or two years (in some adults). In cases lasting under three months it was usually continuous. In those of much longer duration there were intermissions and relapses.

The serum reactions may be briefly summarised as follows:—

Tested by Dr. Edington and Dr. G. W. Robertson:—

34 sera in dil. 1—10 to 1—50.

25 positive with *micrococcus melitensis*.

3 positive with *bacillus typhosus*.

5 negative with both.

By Lieut.-Colonel Birt 54 sera from Philippolis and other districts in the Orange River Colony and in Cape Colony have been found to give positive reactions since August, 1905. Of these 30 were from cases that had recovered, and had been well for periods varying from a few months to eighteen months. The average dilution

for a complete or almost complete reaction in this series was 1—37. The remaining 24 sera were taken from cases during the progress of the disease. In this series the average dilution for a reaction complete or almost complete was 1—242. If the figures of the agglutination limits are taken, a much higher average is obtained. I was enabled to test all the latter myself through the kindness of Lieut.-Colonel Birt and Dr. G. Dean, of the the Lister Institute, who have kept me supplied with reliable emulsions of *micrococcus melitensis* and *bacillus typhosus*. During the year, September, 1905—1906, only three sera reacted positively with the *bacillus typhosus* in my practice.

All of the tests recorded above were efficiently controlled, sera from normal individuals and from cases of typhoid fever and rheumatic fever being used on various occasions as controls in dilution 1—10, with uniformly negative results.

The testing of sera to their agglutination limits naturally involves more trouble and a larger expenditure of the emulsion used. For diagnostic purposes it appears to be quite sufficient to test a serum against the *m. melitensis* in dilutions of 10, 30 and 60, provided a reliable emulsion is used. By a reliable emulsion is meant one which is not agglutinated or sedimented in a dilution of 1—10 in 24 hours by serum from an individual who is not suffering, or has not suffered, from Undulant fever, and which is not auto-agglutinable. According to Birt and Lamb (8) a complete reaction in 1—10 is diagnostic of Undulant fever past or present. This they proved by finding the result negative in 150 sera taken from as many individuals forming a group representing 50 cases of normal health and 100 cases of various diseases other than Undulant fever. (9) Fleet-Surgeon P. W. Bassett-Smith, R.N., more recently working with a dilution of 1—30 found absolutely negative results in 150 cases representing 41 different diseases other than Undulant fever, with four exceptions, which, on further investigation, were found to prove the rule.

If too high a dilution be used the reaction may be missed altogether, especially in chronic cases, as pointed out recently by Captain Crawford Kennedy and Fleet-Surgeon Bassett-Smith (10.) There seems to be a rooted prejudice against the use of low dilutions, based perhaps upon the findings of some who have worked with unreliable cultures. I have seen two reports from two separate Government Laboratories in South Africa,

in which this attitude is shewn. The first was on a sample of blood sent by Dr. D. Campbell at Johannesburg from a case which had been sent down from Pietersburg (Transvaal) diagnosed malaria. Dr. Campbell requested that the blood should be tested for typhoid and for Malta fever, because there was a history of two months' fever with muscular pains and no rigors..

The following is a copy of the report :—

"This serum does not give the Widal enteric reaction.

Micrococcus melitensis was agglutinated in a 5 per cent. dilution, but not in a 1 per cent.

This is probably not diagnostic."

The last statement can be based only upon a want of confidence in the culture used. There is no mention of controls.

Unfortunately the patient passed out of Dr. Campbell's hands into one of the hospitals, and Dr. Campbell, who left South Africa shortly afterwards, was unable to give me the further history of the case.

The other report was on a sample from a very chronic case from Barkly West, Cape Colony. Here 1—60 was the lowest dilution used, and the diagnosis was pronounced doubtful, owing to the feebleness of the reaction. Lieut.-Colonel Birt's report on this patient's serum was as follows :—

To "Native David" *m.m.*

10 complete, 20 nearly complete, 40 marked, 50 marked, 80 trace, 160 nil.

Control. Normal human serum.

To "Native David" <i>m.m.</i>	10	} nil.
	20	
	40	
	80	
	160	

"Native David," resident in Philippolis District, was the individual from whose blood the culture used was grown.

The following quotation from Dr. F. M. Sandwith's "Medical Diseases of Egypt" on the value of the Widal reaction in enteric fever, is applicable almost without qualification to the analogous test for Undulant fever :—
 "A good clinician will soon learn to believe its positive results without putting too much faith in negative reports."

(11) Birt and Lamb have shewn that the information which can be gained by testing a serum periodically to its limits, is of great prognostic value. This means of prognosis is probably second only to the ascertaining of the opsonic index, and can be much more easily used by the general practitioner.

Stronger evidence than the results of serum testing can now be brought to the support of my present thesis. In (12) February 1905, Dr Targett Adams of Bloemfontein reported to me that he had isolated the *m. melitensis* from the blood of one of my patients, and in March 1906 Lieut.-Colonel Birt at London succeeded in isolating cultures of *m. m.* from two blood samples sent from Philippolis; one was taken from a white youth, the other from a native. These cultures were found to be identical with the *m. melitensis* in kind, the only difference being a somewhat higher degree of agglutinability than that exhibited by the Mediterranean strain when tested against serum from South African cases of Undulant fever.

Mode of the Transmission of the Disease.

Although in many instances whole families became infected, the mode of transmission was probably not by direct contagion. There is abundant evidence to shew that in Undulant fever this mode is a rare one. Owing to the recent discoveries in Malta, one's attention was naturally turned to the goat as a probable factor in the spread of the disease. In the district of Philippolis there is a strip of mountainous country about ten miles wide bordering the Orange River. It was thought that the greater prevalence of Undulant fever in this portion of the district might be explained by the fact that here grazing is unsuitable for sheep and the stock consists principally of goats. It was found that the vast majority of those who suffered from the fever had been in the habit of drinking goats' milk in their coffee. The milk was not usually boiled in the coffee, but was added to it unboiled.

In October 1905, blood samples from 14 goats were collected at a farm 29 miles North West of Philippolis, and a few hundred yards from the Orange River, where a whole family had been infected. These were sent to Pretoria to Lieut.-Colonel Birt, who was on the point leaving for England. They were tested by him in England, and only one gave a positive reaction, complete in 1—20.

In February, 1906, one case of Undulant fever was encountered at the farm, Hottentotspoort, about seven miles west of Philippolis. The duration of the illness could not be determined accurately from the history given. It was ascertained that only 20 goats were being milked. A blood sample from each of these was tested in dilution 1—20. The serum of only one goat gave a positive reaction. The following day I went to the farm and took two more blood samples and two milk samples from this goat. The milk was collected in the house with somewhat rigid aseptic precautions. Samples of the blood and milk were sent to Lieut.-Colonel Birt, London, and to Captain Buist, Pretoria. Captain Buist reported:—Serum positive in 1—100, milk sterile. Colonel Birt reported:—Serum positive up to 1—40, milk sterile.

About three miles west of Hottentotspoort is the farm Kleinpaardenfontein, on which live three families. Between the end of December, 1905, and February 1906, I came across seven cases of Undulant fever on this farm distributed as follows: Family P. five cases. Family B. senior, none. Family B. junior, one case, Native servant, one case. All three families had herds of goats numbering several hundred. Family P. was said to be using milk from 17 goats. Blood samples from all of these were found to give negative reactions in dil. 1—20. Now Family B. senior, had hired a portion of the farm from P. in May, 1905. Formerly they had lived at a farm 20 miles north west of Philippolis, and I found two members of this family suffering from Undulant fever in November, 1903. It was therefore decided to examine some of the goats belonging to B. senior. First 10 blood samples were tested in dil. 1—10. One gave a positive reaction, which on further testing was found to be complete up to 1—40. Samples of the blood and milk of this goat were sent to Lieut.-Colonel Birt and to Captain Buist. The milk was thin, serous and very scanty. The blood reaction was confirmed by both gentlemen.

Lieut.-Colonel Birt tested the milk also against an equal amount of *m.m.* emulsion, and found the reaction positive. He failed to get a culture of *m.m.* from the milk, the plates becoming overgrown with saprophytes. The capsule containing the milk sent to Pretoria broke in transit.

A few days afterwards it was decided to do the milk agglutination test with milk from 20 more of B.'s goats.

The method adopted was the hanging drop, an equal amount of milk and emulsion being used, the drops being kept for 12 hours before coming to a negative conclusion. As the emulsion contained 0.5 per cent. phenol it was not considered necessary to add an antiseptic to the milk. Immediately after my return from the farm I put up 10 samples in this manner. No. 10 was a thin serous milk, and clumping all over was complete in half-an-hour. Samples of No. 10 were immediately posted to Pretoria and London. After 12 hours only a narrow margin of the other drops could be examined owing to the presence of the oil globules. Clumping round the margin was observed in Nos. 1, 3, 6 and 9. Next day, the cream having separated, all the samples except No. 10 were put up in hanging drops.

The following was the result :—

Nos. 1, 6, 9, 11, 14, 19, positive in half-an-hour.

Nos. 3, 18, positive after 12 hours.

No. 12, feeble reaction after 12 hours.

Thus 9 out of the 20 gave a positive reaction and one was doubtful.

The positive samples were sent to Pretoria along with two negative controls. They arrived fermented. Captain Buist found practically the same results as I did, but expressed doubts as to their value owing to the state of the milk. Regarding sample No. 10, which was sent first, he had no doubt.

In the Report of the Commission on Mediterranean Fever, Part IV. (14) the conclusion is come to that the milk test is reliable. In no case in which the milk test was positive, was the blood test found to be negative, although some cases of the converse occurred. On the other hand the probability is that the milk test as applied by me was not reliable; for 50 per cent. of one group gave positive reactions with the milk test, while only 10 per cent. of another group from the same herd reacted positively when the blood test was used. It is to be regretted that the individuals of the former group were not marked so that the behaviour of their sera might be ascertained afterwards.

Although no cultures of *m. melitensis* have yet been grown from the milk or blood of South African goats, the serum reactions obtained here, coupled with the abundant evidence as to the culpability of the goat collected in Malta, render it probable that the goat is

a factor in the spread of the disease in South Africa, and may have been the medium through which the disease was introduced to the country. Some fruitless efforts were made to obtain information from the Agricultural Department of Cape Colony regarding the periods at which goats were imported into South Africa, and the countries from which they were imported.

(15) It has been proved by the Commission on Mediterranean fever that dust infected with the urine of men and animals can act as a carrier of the disease.

(16) There is also some evidence that mosquitoes can act as carriers of the germ, and it has been proved that they can infect animals. There is also some circumstantial evidence tending to shew that man can be infected through the bite of a mosquito. In the district of Philippolis mosquitoes are not much in evidence, and can hardly be said to give serious trouble, unless it be during that rainy season which we have yet to see.

Distribution of Undulant Fever in South Africa.

With the object of ascertaining the distribution of Undulant fever in South Africa circulars were sent to medical practitioners in the Karoo portion of the Cape Colony, the Orange River Colony, Basutoland, Natal and the Transvaal. A brief clinical description of Undulant fever (after Birt and Lamb) was given, information as to the presence or absence of this type of fever, and as to the habits of the population in regard to goats' milk was requested, and an offer was made to test blood samples from suspected cases. So far as possible, a circular was sent to at least one practitioner in each district, with a request that it should be brought under the notice of neighbouring colleagues.

The following are the dates of sending, numbers sent, and number of replies received from each colony :—

Date.	Colony.	Number Sent.	Number of Replies.
13th Mar., 1906	Cape Colony	47	25
12th June	„ O.R.C.	62	22
„	„ Basutoland	2	3
10th July	„ Natal	30	8
16th July	„ Transvaal	42	14

It has been deemed best to exhibit the result of this investigation upon a map in which the following notation is used :—

O = Disease not observed.

+ = Disease diagnosed clinically in the past or recently.

* = Blood samples sent gave positive reactions in dilution of 1—30 or over.

? = Presence of disease doubtful from nature of reply.

In Cape Colony the disease has been recognized clinically at Clanwilliam, Hopetown, Prieska, Upington, and Griquatown. The diagnosis has been confirmed by the agglutination test applied to two blood samples from Murraysburg, two from Richmond, two from Kenhardt, and one from Barkly West. There was some doubt whether the last case was not imported from the Orange River Colony.

Kimberley, the home of "Camp Fever," has received the mark (?). Cases of "Camp Fever" were reported to have occurred in Kimberley during last season, but there was a difficulty in getting blood samples, because most of the patients had been sent to the coast. The question whether there is a disease, "Camp Fever," at Kimberley which is neither Undulant fever nor typhoid, has remained long unanswered. I have reason to believe that it will be investigated on the spot during next season.

In the Orange River Colony the disease has been recognised clinically at Bethulie, Springfontein, Luckhoff, Koffyfontein, Reddersburg and Vrede. The information regarding Reddersburg was given by Dr. Jones of Barkly West, who said he had met with many cases at Reddersburg in the early nineties. The coincidence of positive and negative marks at Koffyfontein requires explanation. Here there was a difference of opinions about the same cases. Unfortunately the gentleman in charge, who gave a negative opinion, could not be induced to send blood samples, that the matter might be put to the test, notwithstanding repeated applications.

The diagnosis has been confirmed by the agglutination test applied to sixty-two blood samples from Philippolis, two from Fauresmith, and eight from Senekal.

Considering the prevalence of Undulant fever in the South of the Orange River Colony, it is to be regretted that nothing can be said about the neighbouring portion

of Cape Colony. Correspondence with Petrusville was broken off before a definite decision could be come to, and no replies were received from Philipstown, Colesberg or Aliwal North.

By the Medical Officers at Leribe, Maseru and Mohalieshoek, Undulant fever is believed to be endemic in Basutoland.

The replies from Natal were all in the negative.

In the Transvaal Undulant fever has been diagnosed clinically at Belfast and at Zoutpan.

Negative reactions were found in one blood sample from Boksburg (Transvaal), one from Leribe and one from Mohalieshoek (Basutoland), and one from Pietermaritzburg (Natal).

In concluding this section I have to tender my thanks to those gentlemen who were so kind as to supply me with information and material.

The period during which Undulant fever has been endemic in South Africa is very uncertain. I have been informed by Dr Long of Maseru that Dr. M. E. Leister, now practising in Lerryn, Cornwall, England, recognised the presence of Undulant fever in the Orange Free State and Basutoland twelve years ago. Dr. Heinrich, Murraysburg, Cape Colony, has been meeting with cases of this type for nearly eight years, *i.e.*, the whole period of his residence at Murraysburg. Dr. Gibbon of Prieska reported that he had seen cases of this type many years ago, but that the disease is not endemic at Prieska now.

In the *British Medical Journal*, 1901, p. 941, Washbourn described two cases which he believed to resemble Malta fever more closely than any other disease. The clinical evidence presented by these cases does not exclude enteric fever, as it is met with in South Africa. Pyrexia in the one lasted only four or five weeks, in the other, six or seven weeks. In both there was diarrhoea at the outset, and the motions were occasionally liquid or pultaceous during the course of the fever. In one the tongue was for the most part clean, and, so far as my experience goes, this is an important feature in many cases of Undulant fever. Dr. Dodgson found the serum of both these patients negative to typhoid, and positive to Malta fever. Too much importance may be attached to the negative reactions, but if the positive tests were properly controlled, there can be no doubt about the diagnosis.

It is generally believed that several anomalous types of disease exist in South Africa. In the differentiation

and assignment of these to their proper places, considerable progress has recently been made. Every step in that direction renders the remainder of the problem simpler. Here it seems advisable to discuss the question as to the identity or non-identity of Undulant fever with diseases hitherto regarded as anomalous, whether as types of well-known diseases, such as typhoid fever, or as not being embraced under the established nomenclature of medicine.

Typhoid Fever.—That the prolonged symptomless forms of typhoid fever and Undulant fever may be clinically indistinguishable throughout, there can be little doubt. That acute forms of both may at the outset be indistinguishable without a bacteriological test, is also extremely likely. That many cases of Undulant fever have been returned as typhoids in the past is certain. My certainty is based upon the knowledge of my own erroneous practice for a year, and upon the confessions of others.

Malaria.—Malaria has been called "the refuge of ignorance." To distinguish Undulant fever from malaria we have the bacteriological tests, the absence of rigors, the absence of benefit from quinine. The mistake of failing to make the distinction is more likely to be made in parts of South Africa where Malaria is not endemic, than where it is well known.

Rheumatic fever is extremely rare in the district of Philippolis. I know not what its incidence is in other parts of South Africa where the climatic conditions are similar. Cases of Undulant fever are diagnosed "Rheumatic" in other parts of the world, and it would be strange if the same mistake were never made in South Africa. The Dutch names applied to Undulant fever in Philippolis, if similarly applied elsewhere, may have been responsible for some confusion. These are "Slepende Koorts" and "Zinking" or "Zinkend Koorts." Both are well suited to Undulant fever, the former being applied to comparatively symptomless cases, the latter, to the neuralgic forms. Now I understand that where Malaria is endemic it is called "Slepende Koorts," and where Rheumatic fever prevails it gets the name "Zinking Koorts."

Beri-beri.—A neighbouring practitioner was disposed to regard the Philippolis cases of Undulant fever as Beri-beri, until the contrary was proved. Doubtless the diagnosis of "Beri-beri" where there is much neuritis and

paraplegia would be a pardonable sin. On the other hand few can doubt that the cases in Johannesburg described by (21) Turner and Miller were cases of true Beri-beri. Certain more obscure cases of neuritis which they did not feel justified in including in the series, might have been cases of Undulant fever.

Epidemic Neuritis.—The cases of this type, described by Dr. John Muir (17) are extremely puzzling, and seem to belong to no known category. The neuritis appeared several months after an epidemic of a disease resembling ptomaine poisoning, in which there had been a very high mortality.

Camp Fever.—Reference has already been made to the question whether there is an entity at Kimberley which requires to be classified separately. Dr. Mackenzie's paper (18) on "Camp Fever" presents a good clinical picture of Undulant fever. Dr. Mackenzie recognised the closeness of the analogy. This disease he stated to be prevalent over the whole Karoo as well as in Kimberley. Dr. Mackenzie felt convinced that cases of scurvy in the mines were often associated with this fever. A similar association of scurvy with Beri-beri has been noted.

Where anomalous types of scurvy occur in the future it is to be hoped that the claims to recognition of Undulant fever and Beri-beri will receive due consideration.

That primary uncomplicated scurvy has occurred in South Africa has been shewn conclusively by Dr. N. McVicar (19) and by Dr. D. M. Macrae, who has recently sent a paper on the subject for publication to the *British Medical Journal*.

Treatment.—Till quite recently the treatment of Undulant fever was purely symptomatic. Dr. Reich (20) of Senekal has reported very favourably on the intravenous injection of collargol as a remedy in "Mediterranean Fever." He recommended an injection of 10 c.cm. of a 2 per cent solution daily for three or four days. I have received his permission to state that owing to severity of reactions experienced (vomiting and rigors) he has reduced the dosage and frequency as follows:—5 c.cm. every second day until four injections have been given. The treatment by injection of vaccines, *i.e.*, killed cultures of the virus, has been favourably reported on by Reid. It is based on the opsonic theory of Wright. The general practitioner would find it difficult to apply this treatment; for it involves the determining of the opsonic

index from time to time in order that the effect of the injections may be gauged. If the strength of the agglutinins in the serum bears a direct relationship to the opsonic index, the procedure might be simplified by substituting the determination of the former for that of the latter.

Both the above-mentioned methods of treatment cannot be carried out unless the patient lives within a reasonable distance of his attendant. I have not yet had an opportunity of giving either a fair trial.

In conclusion, the main object of this paper is to show that Undulant fever is widely distributed in South Africa, where it has been endemic for many years. That in all probability the importation of infected goats explains its introduction to this country, and that the goat is now one of the agencies through which it is spread.

To Lieut.-Colonel Birt I owe a deep debt of gratitude for having ungrudgingly examined and reported on all the material sent to him, thus stamping the grounds of my conclusions with the great weight of his authority as a bacteriologist and pathologist.

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NOTE —Since writing the above paper I have been informed by Lieut.-Colonel Birt that he has succeeded in getting pure cultures of *m. melitensis* from two more blood samples sent by me in August

P.D.S.

KEY TO MAP.

CAPE COLONY.	ORANGE RIVER COLONY.	TRANSVAAL.
1. Laingsburg		1. Ventersdorp
2. Prince Albert	1. Bethulie	2. Heidelberg
3. Clanwilliam	2. Rouxville	3. Waterval
4. Sutherland	3. Springfontein	4. Post Retief
5. Beaufort West	4. Philippolis	5. Johannesburg
6. Pearston	5. Luckhoff	6. Boksburg
7. Williston	6. Koffyfontein	7. Nigel
8. Murraysburg	7. Fauresmith	9. Pretoria
9. Carnarvon	8. Jagersfontein	10. Barberton
10. Richmond	9. Reddersburg	11. Komati Poort
11. Hanover	10. Wepener	12. Nylstroom
12. De Aar	11. Bloemfontein	13. Pietersburg
13. Petrusville	12. Winburg	14. Zoutpan
14. Fraserburg	13. Senekal	15. Belfast
15. Hopetown	14. Ficksburg	
16. Prieska	15. Ventersburg	NATAL.
17. Kenhardt	16. Vredefort	1. Impendhle
18. Upington	17. Frankfort	2. Umzinto
19. Griquatown	18. Vrede	3. Howick Falls
20. Kimberley	19. Heilbron	4. Pietermaritz- burg
21. Barkly West	BASUTOLAND.	5. Durban
22. Taungs	1. Mohalieshoek	6. Krantzkop
23. Mafeking	2. Maseru	
24. Douglas	3. Leribe	





