favourable circumstances will make the attempt to see if colours can be made to afford a practical means of protection.

REFERENCES.

¹ *Practitioner*, March, 1901, p. 341. ² *Indian Medical Gazette*, April, 1901, p. 195. ³ *Arch. de Parasitologie*, May, 1901, p. 259.

A FURTHER NOTE ON THE BIOLOGICAL TEST FOR BLOOD AND ITS IMPORTANCE IN ZOOLOGICAL CLASSIFICATION.

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In a former number of the *BRITISH MEDICAL JOURNAL* I published a preliminary note regarding the results of experiments with specific antisera, a complete account of which appeared in the *Journal of Hygiene* for July. As stated in the latter publication we had gone a step further than mentioned in the preliminary note, finding it possible to detect human blood, or any other blood for which we had prepared a test serum, when that blood had been mixed with five or six other bloods, each blood in the mixture being present in the proportion of 1 to 500 or 1 to 600. In the papers above cited it was stated that 36 bloods had been tested. I have since tested 140 bloods, the result being consistent with what has been already described.

The 140 bloods tested were derived from all classes of vertebrates. None except monkey bloods gave a reaction with the antiserum for human blood. The monkey bloods tested were the following: Family *Cercopithecidae*, *Semnopithecus entellus* (India), *Cercopithecus Campbelli*, Waterh. (W. Africa), *C. patas* (W. Africa), *C. lalandi*, Is. Geoffr. (S. Africa), *C. diana* (W. Africa), *C. melogenys* (W. Africa), *C. callitricha* (W. Africa), *Macacus rhesus* (India, 3 blood samples); *M. cynomolgus* L. (India, 2 blood samples) *M. assamiensis* (India). Of the South American monkeys, family *Cebidae*, only two bloods have been tested: *Mycetes seniculus* (Colombia) and *Cebus albifrons* Geoffr. (South America).

All the bloods of the Old World monkeys gave a very marked reaction, less powerful, however, than that of human blood. They also reacted to weak antiserum. On the other hand, the South American monkeys gave but a slight reaction with human antiserum as compared with that of the other monkeys, and a weak antiserum produced no precipitation in the blood of *Mycetes seniculus*. Of course these tests require further study, but the result is in striking accord with the Darwinian theory as to the relationships existing between man and apes, the relation of the former, according to that theory, being closer to the Old World apes.

Tested on 140 bloods, the antiserum for dog's blood only gave a reaction with the blood of the jackal (*Canis mesomelas*) from South Africa. I have not as yet had an opportunity of testing the blood of other members of the canine family. None of the 140 bloods gave a reaction with the antiserum for horse blood; in this case no other members of the horse family were tried. The antisera for ox and sheep blood only gave a full reaction with their homologous bloods, besides the slight reactions already mentioned in my previous communication.

Further tests have shown that ox antiserum produces a slight reaction with the blood of the goat, and a faint clouding in that of the roebuck and Burrhel sheep (*Ovis Burrhel*, from the Himalayas, of which two samples were at my disposal). Sheep antiserum furthermore gave a marked reaction with the blood of the Burrhel sheep and of another wild species of sheep, a slight but distinct reaction with the blood of a goat, and a faint clouding with that of the roebuck.

My investigations have been greatly furthered by the kind interest of Mr. Frank E. Beddard, F.R.S., Prosector of the Zoological Society's Gardens, and his assistant, Mr. E. Ockenden, as also by friends in different parts of the world, whose assistance I shall take occasion to acknowledge more fully elsewhere. I shall be greatly indebted to any readers of this article who may aid in the prosecution of this work, which I contemplate pursuing on an extended scale. I shall

naturally fully acknowledge any aid which may be given. The object of my research is to gradually produce various antisera besides those already mentioned, and by means of them to study the reactions which take place with the bloods of various groups of animals. It seems certain that interesting results from the point of view of zoological classification will thus be brought to light. Apart from this, owing to the importance of the reaction from a medico-legal standpoint, the test should be applied to as large a number of bloods as possible. The method of collecting bloods for the above-mentioned purpose is exceedingly simple, and is as follows:

METHOD OF COLLECTING BLOOD.

Blood may be collected from dead or living animals. It does not matter which, nor does it have any effect on the test if the animals have been dead as long as twenty-four hours, except in tropical countries. The method is so simple that sportsmen can readily collect samples whilst out shooting. The method consists in soaking up the blood (avoiding clots) upon strips of pure filter paper about 3 inches wide by 5 inches long.

One end of the strip is left clean, so that the name of the animal (both common and scientific), the date, place (of collection or natural habitat) and name of the collector can be noted thereon in lead pencil. The notes should be written clearly, this being facilitated by resting the paper upon a hard surface. The strips of paper dry rapidly when suspended in the air (sunlight can be used for hastening the drying) by being pinned against the edge of a table, shelf, or upon the branch of a tree. Strips of paper saturated with different bloods should not be brought in contact with one another in a moist state. If the collector is unable to wait for the strips to dry he can place them between sheets of impervious paraffined paper. The whole outfit can be carried in an ordinary envelope. When the strips have dried thoroughly, they may be folded and placed together in an envelope for transmission, at the collector's convenience, as an ordinary letter through the mails. It does not matter if the dried strips have been preserved for a month or two before being sent.

One strip of paper saturated with each kind of blood will suffice for the purposes of the investigation. I shall be happy to forward strips of filter paper, etc., to those who may be interested or willing to collect. Blood samples may be addressed to me as noted.

If it is desired to collect bloods from living animals this can be readily accomplished by pricking the skin with a needle, and soaking up a few drops on different parts of the filter paper.

INOCULATION AND THE INCUBATION STAGE OF PLAGUE.

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DR. CALMETTE is reported to have given it as his opinion that a person in the period of incubation for a slight attack of plague would find the disease considerably aggravated if he submitted during this period to a preventive inoculation of Haffkine's vaccine. The case would almost certainly end fatally.¹

The same opinion is again urged in the third Harben Lecture,² lately delivered by Calmette in London, and the advice given to refrain from inoculating those in direct contact with a plague case, though the measure is recommended as a means of immunising a population living round a plague centre.

As Haffkine, on the contrary, has all along maintained that inoculation with his vaccine is harmless in the incubation period of plague, and that this method of protection should be pushed with the utmost vigour amongst those immediately in contact with plague cases, it becomes necessary to examine this matter afresh, in the light of the extensive experience gained in India and elsewhere in the use of the plague prophylactic.

Calmette's ideas have been derived from laboratory experiments, for he has had no opportunity of studying the effect of plague vaccination during an epidemic among human beings. In India, on the contrary, hundreds of thousands of persons have been inoculated with Haffkine's plague vaccine,

Names of Places where the Inoculations

Interval between Inoculation and Attack.	Byculla Gaol (Dr. Haffkine).			Damaon (Dr. Haffkine and Major Lyons).			Undhera (Dr. Haffkine).			Billimora and Koli (Dr. Mehla).			Dharwar : among those once inoculated (Dr. Corthorn).			Dharwar : among those inoculated for the second time (Dr. Corthorn).			Gadag : among those once inoculated (Dr. Corthorn).		
	Attacks.	Deaths.	Case-Mortality per cent.	Attacks.	Deaths.	Case-Mortality per cent.	Attacks.	Deaths.	Case-Mortality per cent.	Attacks.	Deaths.	Case-Mortality per cent.	Attacks.	Deaths.	Case-Mortality per cent.	Attacks.	Deaths.	Case-Mortality per cent.	Attacks.	Deaths.	Case-Mortality per cent.
Plague developed on day of inoculation or previously	3	3	100.0	2	2	100.0	—	—	—	—	—	—	10	3	30.0	3	1	33.3	6	2	33.3
Plague developed on 1st day	—	—	0.0	—	—	—	—	—	—	—	—	—	2	1	50.0	—	—	—	—	—	—
" " 2nd day	—	—	—	—	—	—	—	—	—	—	—	—	11	3	27.2	—	—	—	—	—	—
" " 3rd day	—	—	—	4	2	50.0	2	1	50.0	—	—	—	5	4	80.0	—	—	—	—	—	—
" " 4th day	—	—	—	—	—	—	—	—	—	—	—	—	2	1	50.0	—	—	—	—	—	—
" " 5th day	—	—	—	—	—	—	—	—	—	—	—	—	10	5	50.0	—	—	—	—	—	—
" " 6th day	—	—	—	1	—	0.0	—	—	—	—	—	—	9	6	66.6	—	—	—	—	—	—
" " 7th day	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
" " 8th day	—	—	—	7	2	28.6	—	—	—	—	—	—	9	2	22.2	—	—	—	—	—	—
" " 9th day	—	—	—	3	2	66.6	1	1	100.0	—	—	—	1	—	0.0	—	—	—	—	—	—
" " 10th day	—	—	—	5	2	40.0	—	—	—	—	—	—	10	2	20.0	—	—	—	—	—	—
Plague developed after 10th day	—	—	—	65	24	36.9	5	1	20.0	34	21	61.7	61	25	41.0	26	9	34.5	10	8	80.0
Total plague cases among the inoculated during the epidemic	5	3	60.0	91	36	39.5	8	3	37.5	39	25	64.1	135	52	38.5	33	12	36.4	31	15	48.4
Plague cases (which occurred after the date inoculation was begun) among the uninoculated in same communities	27	14	51.8	—	1,482*	—	27	26	96.3	94	79	84.04	1,100	889	80.8	—	—	—	268	213	79.4

* Number of cases among the uninoculated in Damaon not known, therefore the number of deaths is also omitted from the grand total.

and evidence has been now accumulated with sufficient accuracy to enable one to refute entirely the above suppositions of Calmette.

The remedy which we owe to Haffkine's genius, and which has passed successfully through the ordeal of examination by the Government Plague Commission, would be shorn of half its usefulness if it could not be used with perfect safety in the very presence of plague itself.

The table above has been compiled from records of reports submitted to Government by various officers,³ after most painstaking collection of the facts.

The plague death-rate in an uninoculated Indian population varies of course with each epidemic, but may be taken as somewhere between 75 and 85 per cent.; so if Calmette's statement were true we should see among those inoculated in the incubation stage of plague a higher mortality than that in the table printed above. Far from this being the case, we see that those who were actually suffering from plague at the time of inoculation had a case-mortality of 48.8 per cent. only, which also closely approximates to the death-rate in the same outbreaks among those developing plague more than ten days subsequent to operation.

It is the universal opinion of plague inoculators in this country that it is advisable to operate on all who have been exposed to infection. Miss Alice Corthorn, M.B.Lond., who performed some 32,000 operations with her own hand in the towns of Dharwar and Gadag, says⁴:

I think that these and the Dharwar figures prove that so far from its being inadvisable to at once inoculate the contacts of a case of plague lest they be incubating the disease, it is desirable at once to inoculate all who have been exposed to infection. Precisely as in the case of small-pox breaking out, one vaccinates any unprotected person who has been exposed to the infection with the hope that the intervening vaccination shall modify at least the attack of small-pox, should this follow, so inoculation in those exposed to plague infection may be looked on as tending to avert attacks which would otherwise occur were no artificial protection given.

In a report on the outbreak of plague in Sydney, New South Wales, in 1900, submitted to the Government there by Dr. Ashburton Thompson, it is noted:

Among the inoculated public 13 were attacked. All these patients not merely recovered but had conspicuously light attacks. The cases occurred almost entirely among the earlier 200, while the virulence of the infection was at its highest (p. 12). It will be noticed that attacks which occurred at or before the lapse of about ten days from inoculation were not aggravated by it (p. 13).⁵

The figures given in the table (being all that are available

from the reports yet published) are sufficiently large to enable any one studying them to arrive at a conclusion on the subject of the effect of inoculation on the case-mortality among persons who may be in the incubation stage of plague, or those in whom the symptoms of plague are already developed. In neither case can it be said that this is increased, but, on the contrary, it is seen that no harm results from the injection of Haffkine's plague vaccine in the very presence of plague itself.

But in addition to this the table furnishes interesting evidence in support of another of Haffkine's contentions, namely, that the prophylactic begins to act beneficially after a lapse of twenty-four hours only. This pronouncement he first tentatively gave out after a study of the effect of inoculation in the House of Correction at Byculla, Bombay, in January, 1897; and a study of cases where—as at Undhera, for instance—the inoculations were all performed at one time, shows that this opinion is correct. In such cases the incidence of plague in the two groups is easily compared, though the same information may be equally derived from communities where operations are not all performed at one time. In all cases where a plague-stricken community has been divided into halves—one inoculated and the other not—and where accurate observations have been kept, it is found that the difference between the two portions has begun from the day following the operations. In explanation of this fact only two alternatives present themselves; either (a) the inoculators must have some mysterious method of selecting only those persons for inoculation who are not in the incubation stage of plague, or (b) the prophylactic itself must have the power of aborting the disease in this stage.

The Indian Plague Commission state⁶:

In Undhera, though plague continued among the uninoculated at the rate of 10 cases in the first week after inoculation, there were among the inoculated two persons, at most, who can be regarded as having contracted plague at the time of inoculation.

What is meant by this awkwardly-worded sentence is evidently that during the week succeeding February 12th, when the inoculations were performed, 10 persons belonging to the uninoculated group (which numbered 417) developed symptoms of plague, while among the 513 inoculated only 2 did so. At least these are the facts; and one may legitimately ask why did not the 513 inoculated furnish 11 (actual number 11.7) cases of plague within this period as they should have done, had they suffered in the same proportion as their 417 unin-

were Performed and Name of Reporter.

	Attacks.	Deaths.	Case-Mortality per cent.	Gadag : among those inoculated for the Second Time (Dr. Cor-thorn).
—	149	4	100.0	
—	58	2	100.0	
—	39.0	100.0	—	
244	14	1	—	Ahmednagar Villages (Mr. Anderson).
174	7	—	—	
71.3	—	100.0	—	
42	29	2	50.0	Ahmednagar Villages (Mr. Hudson).
36	16	—	—	
85.7	—	100.0	—	
2,253	12	13	100.0	Ahmednagar City and District (Major Sarkies).
1,708	8	1	100.0	
75.8	—	100.0	—	
628	142	7	63.6	Dharwar from Report of Indian Plague Commission (Dr. Hornbrook) †
404	30†	4	44.4	
64.3	32.2†	5	37.3	
290	2	1	—	Sydney (Dr. Ashburton Thompson).
103	—	—	—	
35.5	0.0	0.0	0.0	Bulsar (Dr. Dadachanj).
23	59	2	—	
15	23	1	—	Aden (Dr. Mehta).
65.2	—	100.0	—	
83	7	3	—	
65	8	3	—	
78.3	—	100.0	—	
5,079	566	43	—	Grand Total for all these Places.
3,726	230	21	—	
73.7	—	48.8	—	

† Hospital figures only. ‡ After five days subsequent to inoculation.

oculated relatives? We prefer to think that the inoculations account for the difference rather than believe with the Commissioners that only two among the inoculated had already "contracted plague" before the inoculations were performed.

Divination is not possible in these days even in India, and without invoking its aid the commissioners could not possibly diagnose how many had "contracted plague at the time of inoculation." We presume that "at" in the above quotation is a misprint for "before."

From a study of the figures of the "grand total" column in the above table, it is manifest that there is very little difference between the percentage case-mortality in those attacked respectively before and after the first ten days period subsequent to inoculation, the figures being 48.04 per cent. up to the ten days' interval, and 40.6 per cent. for the subsequent period.

The variations noted from day to day, and the small difference in the rates between the beginning and end of the ten-day period, seem to point to a sudden very considerable measure of protection being secured after the lapse of twenty-four hours only, though this desirable effect no doubt increases slightly with lapse of time.

NOTES AND REFERENCES.

NOTES AND REFERENCES.

¹ Report by Calmette to the International Congress of Hygiene and Demography, at Paris, September, 1900, as abstracted in the BRITISH MEDICAL JOURNAL, October 27th, 1900, p. 1255. ² BRITISH MEDICAL JOURNAL, November 24th, 1900. ³ Abstracts of all the reasonably accurate statistics collected up to date may be found in the following: Statistics of Inoculations with Haffkine's Antiplague Vaccine, 1897-1900, compiled from Records of the Plague Department of the Secretariat and the Plague Research Laboratory, Bombay, by W. B. Bannerman, M.D., B.Sc., Major Indian Medical Service, Superintendent Plague Research Laboratory; Bombay: Government Central Press, 1900; price 6d. ⁴ Report on Anti-plague Inoculation Work in the Dharwar District, by Alice M. Corthorn, M.B., B.S., Medical Officer on Plague Duty; Bombay: Government Central Press, 1899. ⁵ Report on an Outbreak of Plague at Sydney, 1900, by the Chief Medical Officer of the Government and President of the Board of Health; Sydney: William Applegate Gullick, Government Printer, 1900. ⁶ Report of the Indian Plague Commission, chap. iv, para. 75, p. 73.

THE LIGHT TREATMENT AT SHEFFIELD.—There seems, if we may trust statements made apparently on good authority in the local press, to be a prospect of the light treatment of lupus soon being available both in the Royal Hospital and the Royal Infirmary, Sheffield. The Hospital Board is said to be taking immediate steps for the installation of the necessary apparatus, while the Infirmary Board has the matter under consideration.

ALBUMINURIA IN PLAGUE.

By ALICE M. CORTHORN, M.B., B.S.LOND.,

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Plague Hospital, Poona, India.**

DURING the Poona plague epidemic of 1900-1 868 patients were admitted into the General Plague Hospital who were suffering from this disease. Although it has been generally observed that albumen is present in the urine of plague patients, and the examination of the urine in isolated cases has been of a very exhaustive nature, there has been no attempt reported, so far as I am aware, to make a systematic daily examination of the urine of all patients coming under observation, whether suffering from a severe or a mild form of the disease, and in this way to obtain some evidence as to the significance of any morbid bodies present for the purposes of prognosis. I thought it of interest therefore, by means of daily examinations for each and every patient in the hospital, to record the presence or absence of albumen, its degree, and duration in cases which remained long enough under examination.

In the report of the Austrian Commission, vol. i, p. 200, the opinions of previous investigators are quoted, and these vary somewhat. According to Aoyama albuminuria is moderate. Bittu found albumen in most cases, generally very moderate in amount, and invariably present in fatal cases. Yamagiwa found albumen only rarely.

The members of the Commission report that they were able to examine the urine in 45 cases, in several continuously. They found the specific gravity generally very low and albumen to be present in all cases where repeated examinations were possible. The quantity increased to the third day of observation. Generally the albumen appears to have been moderate in amount—under $\frac{1}{2}$ per cent., as measured by Esbach's apparatus.

Mr. R. N. Jadhav, the medical officer in charge of the Baroda Plague Hospital, stated before the Plague Commission (Minutes of Evidence, vol. ii, p. 285) that all cases he examined contained albumen varying from $\frac{1}{4}$ to $\frac{3}{8}$, but he does not state whether all cases, including those who convalesced were examined. My own aim was to make a daily examination of at least one specimen of the urine of each patient in the hospital until the disease had terminated either in death