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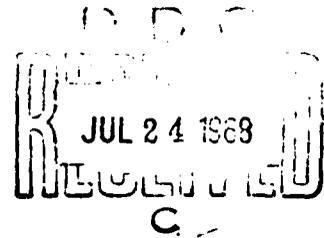
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RESULTS OF ANTIPLAGUE VACCINATIONS IN  
THE FRENCH COLONIES

[Following is the translation of an article by Medical Inspector General Boye, Inspector General of the Medical Service of the Colonies (Inspecteur general du Service de Sante des Colonies), Delegate of French Equatorial Africa (Delegue de l'Afrique Equatoriale Francaise), presented to the Standing Committee of the International Office of Public Health (Comite permanent de l'Office International d'Hygiene publique) during its April-May 1932 meeting and published in the French-language publication Bulletin de l'Office International d'Hygiene publique (International Office of Public Health Bulletin), Vol XXIV, 1932, pp 1610-1622.]

Three French colonies ([Note:] In this article only those territories that depend on the Ministry of Colonies are dealt with, excluding, therefore, Morocco, Algeria and Tunisia) are subject to a plague endemic that undergoes a seasonal recurrence on the spot every year. They are: Senegal, Madagascar and Indo-China, the latter very mildly and only within some very well defined areas.

I shall not be able to answer categorically a certain number of points appearing on the questionnaire drawn up on 20 July 1931 by the International Office of Public Health (Office International d'Hygiene publique). In fact, it follows from the documents forwarded by the Colonies that, in most cases, it has not been possible to set apart controls exposed to the same dangers of contagion as persons who had been inoculated. In order to avoid the danger of having the disease spread, the greatest number of people possible received vaccination. Moreover, due to indifference and indocility on the part of the natives to show up to receive, the second vaccination, when occasion required it, and due to difficulties in identifying individuals in races in which homonymy is frequent, it was very difficult, in quite a few cases, to state that such an individual, affected with plague or healthy, had been properly vaccinated with one, two or three injections, according to the nature of the vaccine used ([Note:] Except when it was a question of groups under close supervision, troops, schools; prisons, it is already very difficult to have natives come to get a second injection, let alone a third one.) The difficulties were complicated still more by the fact

that vaccination cards were often lost. In this case it was necessary to accept the natives' statements, always unreliable.

For some years now there has been no epidemic explosion in the French colonies. Plague is endemic there; every year periodically, when the season brings about favorable conditions, more or less numerous cases appear, striking one village and sparing others that had been hard hit occasionally the year before. From the point of view of prophylaxis, it has become the practice, therefore, to administer the greatest possible number of vaccinations in these areas of endemicity at the usual time for the plague to reappear.

The foregoing explains why I have been unable to give precise answers to the following points on the questionnaire:

- A. 2: at what period with respect to the epidemic was vaccination administered?
- 3: what was the frequency of plague cases with respect to the population exposed to the danger?
- 4: what is the degree of certainty that persons carried as vaccinated have really been so?
  
- C. 3: after how much does immunity seem to have been achieved?  
And is there a period of increased sensitivity immediately after vaccination?  
How long does the immunity appear to last?
- 4: Has a relationship been established between the intensity of the reaction and the apparent immunity achieved?
  
- D. Percentages of plague cases in vaccinated persons and unvaccinated?

Mortality Rate among Vaccinated and Unvaccinated Persons.

I have received accurate information from Senegal concerning mortality rates among vaccinated and unvaccinated persons. Of 237 patients treated in the Dakar hospital with identical therapeutic methods and under absolutely comparable conditions, 128 individuals that had been vaccinated for more than a month and 109 unvaccinated people were found. There was a 37.5% mortality among the former and 52.2% among the latter, or a survival gain of 15% among the vaccinated individuals.

In the absence of precise replies to most of the points in the questionnaire, I am going to attempt to extract from the numerous reports forwarded by the Colonies facts that can throw some light on this still very controversial question of the degree of effectiveness of the antiplague vaccines presently in use.

### Nature of the Vaccines Used.

1. Indo-China: An aqueous vaccine prepared by the Saigon Pasteur Institute was used exclusively. The following are the data provided, on this subject, by Dr. Noel Bernard, Director of the Pasteur Institutes in Indo-China, on its method of preparation.

The strains are derived from Yersin's bacilli isolated from patients and are renewed as often as circumstances permit by selecting the most virulent ones. Cultures on gelose. Master dilution in physiological water heated for one hour at 60°. Then the master dilution is added in the same physiological solution without adding antiseptics so as to produce a concentration of five to six billion germs per cubic centimeter.

The first injection is one cubic centimeter. The second, 8 to 10 days later, two cubic centimeters.

2. Madagascar and Senegal: Three types of vaccines are used; the first two are prepared by the Paris Pasteur Institute, the third one by a laboratory that specializes in the preparation of vaccines with an oily excipient, the lipovaccine laboratory in Paris.

A. Antiplague vaccine: The strains used for preparing this vaccine come from recent cases of human plague. Their virulence is maintained by frequent transfers to laboratory animals. The cultures are made on gelose in Roux's boxes. After three days in the incubator (28° - 32°), the boxes are scraped in a small amount of physiological water. This master emulsion is diluted with 5 to 6 cubic centimeters per liter of formol (commercial 40% solution) and distributed in sealed flasks that are placed in the incubator (37 to 38 ) for about one week.

Physiological water without formol is then added to this formulated master emulsion in such a proportion that the collection from each of the boxes is diluted in 500 cubic centimeters of physiological water.

This vaccine, containing about three billion germs per cubic centimeter, is distributed in 10 and 20 cubic centimeter ampules.

B. Antiplague vaccine called P.S.T.: This vaccine is derived from the pseudotuberculosis bacillus of rodents (Vignal Malassez bacillus). Studies by MacConkey, Boquet and Dajardin-Beaunetz demonstrated, as early as 1926, that the vaccine derived from this bacillus immunised guinea-pigs against plague more effectively than the plague bacillus itself. Hence the idea of applying it to human protection against the plague, which was tried out experimentally in Madagascar.

The strain used by the Pasteur Institute in the preparation of this vaccine comes from a spontaneous case of pseudotuberculosis in a

monkey. It is especially virulent.

The cultures were made under the same conditions as were pointed out above. The amount of formol is the same and the collection from each box is diluted in 500 cubic centimeters of physiological water without formol.

P.S.T. vaccine contains about four billion germs per cubic centimeter (data provided by Dr. Dujardin-Beaumetz, Head of the Plague Section in the Paris Pasteur Institute).

C. Antiplague lipovaccine: The following are the data provided by the administration of the lipovaccines laboratory on the production of this vaccine:

The strains used are the same ones used to produce aqueous vaccines and the P.S.T. vaccine of the Pasteur Institute. Cultures on gelose for three days. The product of scraping is diluted in a sodium chloride physiological solution with the addition of 5 cubic centimeters of formol per liter. Heated for one hour at 58°. Then, centrifugation, drying and incorporation with oil. Eleven grams of microbial bodies obtained in this manner are mixed with one liter of oil, which yields about twelve billion germs per cubic centimeter, or six billion plague bacilli and six billion pseudotuberculosis bacilli of rodents. Consequently this vaccine is a mixed vaccine, at least for the last two years. Formerly it contained only Yersin's bacillus.

The advantage of the oily excipient is that the slowness of absorption of this liquid permits the injection of very strong single doses without fear of the strong reactions and the inevitable accidents that would be caused by using the same doses in an aqueous excipient. This advantage is considerable when it is a question of indocile natives whom it is difficult to recall to administer the second injection, especially if the first one has induced somewhat strong reactions.

#### Results of the Vaccinations.

The following now are the data for each of the colonies taken from the reports of the directors of the Health Service on the effectiveness of antiplague vaccinations.

Indo-China: The plague which had appeared with intensity from 1908 to 1923 in Cochin China, in Cambodia and in Annam is limited at present to three permanent areas: one, very small, at Cholon in Cochin China (about thirty cases a year); a second one, larger, in the city of Pnom-Penh in Cambodia; and finally a third, on the Island of Tang-Hai in the Kwangchowan territory.

It is impossible to determine the part played by vaccinations in

the disappearance of the plague from most of the territories where it prevailed formerly, for vaccinations were only part of the prophylactic measures taken on occasion of each case: isolation of the patients and of their contacts; closing the contaminated premises after disinfection; destruction of rats, etc.

During the plague epidemics that followed each other in Annam from 1908 to 1915, vaccinations were administered with Haffkine's vaccine. Now the efficacy of this vaccination, from the point of view of decreasing the seriousness of the attacks, was evident in those cases in which it was possible to draw up exact lists of persons who had been vaccinated. For example at Phanri:

22 cases in natives definitely vaccinated produced 12 deaths = 57%.  
27 cases in natives who had not been vaccinated produced 26 deaths = 97%.

Later serovaccination was used in accordance with Calmette's procedure (two parts of serum and one part of Haffkine), primarily in order to establish an immediate immunity in the people around the patients.

Then the Pasteur Institute antiplague vaccine and the lipovaccine replaced Haffkine's vaccine.

In his report Surgeon General Gaide, Director of the Indo-China Health Service, refers to various circumstances under which vaccination seemed to have a certain effectiveness. I have underlined the word "seemed", because the fact that I am about to reproduce can lend itself to various interpretations:

"A center of infection broke out in My-Hoa (Annam), a village of 3,000 inhabitants, on 26 October 1921. The disease that caused 54 cases with 31 deaths was checked in 25 days, thanks to 2,235 vaccinations and 2,106 revaccinations that were administered both in My-Hoa and in the neighboring villages with Pasteur Institute vaccine. This center flared up again three months later and manifested its activity during the entire first quarter of 1922, requiring the application of the same measures. Six thousand one hundred eleven vaccinations and revaccinations were administered in January and, in order to avoid another offensive return of the disease, in view of the short duration of the immunity that the vaccine appeared to provide, 2,409 inhabitants were vaccinated or revaccinated in May and 2,120 in November. The last case was disclosed on 21 March. This center did not flare up the following year."

If the effect of the vaccination was really positive, it must be recognized that the immunity was very short-lasting, because less than

three months after their inoculation some natives had become susceptible again and because, in spite of the renewal of revaccinations -- 6,111 in January ---, some cases continued to manifest themselves until March.

A very deadly plague epidemic prevailed in Kampot (Cambodia) from April to July 1923: 142 cases, 133 deaths. Two thousand one hundred eighty-five persons, among whom every European, the native administrative personnel, the military, prisoners, pupils in the schools and 1,200 Chinese, received two inoculations at the beginning of April: one cubic centimeter, then two cubic centimeters at an interval of one week.

It was not possible to make a definite check of the second vaccinations, because some natives came too soon after the first injection, others did not return and stated the contrary. Nevertheless, some of them contracted plague after two perfectly proper injections.

The Director of the Indo-China Health Service concludes from his whole study: "that it cannot be stated that the vaccine surely protects after two inoculations; but it may be said that the irregularity of the results obtained and the occurrence of failures alongside of examples that prove individual protection do not preclude the antiplague vaccination, correctly applied and administered extensively, from causing an epidemic to recede, although it does not ensure immunity to all those who are vaccinated."

Madagascar: In Madagascar the following facts were established for the last eight years (plague years counted from July to July):

1923-1924:	1,332	cases,	1,134	deaths,	or	85%	
1924-1925:	1,629	"	1,336	"	"	82%	
1925-1926:	1,969	"	1,810	"	"	92%	
1926-1927:	2,444	"	2,151	"	"	88%	220,000 revaccinations
1927-1928:	2,278	"	1,951	"	"	86%	300,000 "
1928-1929:	2,172	"	1,963	"	"	86%	400,000 "
1929-1930:	2,077	"	1,969	"	"	90%	323,000 "
1930-1931:	2,305	"	2,165	"	"	94%	298,000 "

The number of inhabitants living in the provinces of the large island that are contaminated with the plague is estimated as 900,000. Therefore approximately one third of the exposed population is vaccinated each year.

It follows from the above table that since 1926-1927 the annual number of cases and the mortality rate have remained perceptibly the same.

It must be noted, nevertheless, that while from 1923 to 1926 the progression of cases was constant, it has remained stationary starting with 1926. It is possible that vaccination has limited the extension

of the disease. At least this is one hypothesis. The proportion of deaths in relation to the number of cases has remained the same, which would seem to indicate that the vaccine does not have any effect on the gravity of the disease, but it is well to point out that almost all the cases of plague that have come to the attention of the Health Service are mortal cases. Cases cured spontaneously are not reported by the natives, in order to avoid disinfection measures, and they escape checking for the most part. Thus no conclusion may be drawn, in one sense or another, from the constancy of the percentage of deaths.

An obstacle to the effectiveness of the aqueous antiplague vaccine of the Pasteur Institute lies in the fact that, in order to obtain an immunity for about six months, the administration of three inoculations at intervals of one week is recommended. Now since this is already difficult for two inoculations, it is practically unfeasible for three, except in supervised groups such as bodies of troops and prisons. It must be recognized that, in these groups, cases of plague are exceptional; health rules are particularly observed in them, in contrast with what happens in the native villages. Therefore, is this not an example that proves the effectiveness of the vaccinations? In so far as the number of injections is concerned, it did not appear that the use of the lipovaccine, consisting of only one injection, yielded a better result. This fact has been especially verified in Senegal where it is used as much as the aqueous vaccine of the Pasteur Institute.

The following example, cited in a report by Major Girard, Medical Corps, Director of the Pasteur Institute in Tananarive, demonstrates how careful it is necessary to be in drawing conclusions in favor of vaccination from certain epidemiological facts:

"In 1923-1924, when I proceeded to make small amounts of antiplague vaccine using local strains, I went to a bush village where the plague had just claimed two victims. It was the first time that the village had been infected. I vaccinated 150 inhabitants, or about half, being careful to take natives from each hut. In the following month, some cases of plague occurred: two among those who had been vaccinated and one among the controls who had not been vaccinated; all were mortal and bubonic in form. No other measure was recommended and the plague disappeared from the village. No doubt if I had vaccinated everybody, I might have attributed the abrupt discontinuance of the plague to my local strain vaccine. The experiment demonstrates, however, that vaccination had nothing at all to do with it."

In Madagascar there have been very many cases of plague occurring in persons definitely vaccinated with two injections of vaccine from the Paris Pasteur Institute or from the one in Tananarive, and even with two injections of lipovaccine and after a period in which immunity had

to be presumed established, that is four weeks to three months after inoculation.

In 1926, when experiments demonstrated that the agent of pseudotuberculosis of rodents immunized guinea-pigs against the plague more effectively than the plague bacillus itself, a first test on man took place in Madagascar in 1927 on 2,000 natives. It appeared to be favorable and the use of this P.S.T. vaccine was extended consequently. In 1930-1931, 70,000 natives of a population of 100,000 were vaccinated in this way. It is quite necessary now to recognize, after almost five years of experience, that the initial hopes have not been attained and that the P.S.T. vaccine, as well as the other vaccines used, has proved to be incapable of suppressing the plague in Madagascar. Dr. Girard says, nevertheless, that "a single two cubic centimeter injection, renewed every year, has perhaps limited the extent of the scourge, in view of the halt in the rapid progression that had appeared from 1921 to 1928." This is the conclusion from his study.

Senegal: After it had been introduced in Senegal in 1914, the plague took root in an area about sixty kilometers wide bordering on the Atlantic coast. Some centers developed, however, east of this area, but they were due to imported cases; they were put down on the spot without reappearing the following years.

The first cases occur regularly every year toward the end of the cool season, in February-March, and continue until November or December, the time when the cool season returns. Every village in the endemo-epidemic area is not touched every year. Some of them, however, remain healthy for a more or less long time.

The population of the contaminated region is about 455,000 inhabitants, 54,000 of whom are in the Dakar territory alone. Tracing back the last five years, we have:

1927:	2,439 cases,	1,337 deaths,	31,312	vaccinations
1928:	2,013 "	1,179 "	116,590	"
1929:	2,585 "	1,528 "	161,905	"
1930:	1,860 "	1,034 "	485,130	"
1931:	885 "	605 "	445,884*	"

\* Incomplete figure as far as the portion corresponding to the Territory of Dakar is concerned where the amount of vaccinations has been given up to 31 July only.

Initially the aqueous vaccine of the Paris Pasteur Institute was used exclusively. Then it was replaced by the P.S.T. vaccine and by the mixed lipovaccine containing germs of Yersin's bacilli and of bacilli of pseudotuberculosis of rodents. For about a year now the content in microbial bodies has been increased considerably. The vaccine being used

at present contains twelve billion per cubic centimeters.

It is evident that the number of plague cases underwent a considerable decrease in 1931 in comparison with the preceding years. Must this decrease be attributed exclusively to the considerable amount of vaccinations administered that year and the year before? Nothing justifies our stating this, for when the Health Administration was faced with the increasing danger revealed by the number of cases that had reached 2,585 in 1929, it took a number of steps whose effectiveness was not doubtful.

First of all, fight against the pullulation of rats; ratproofing of all grain storehouses. Setting up in villages having more than 100 inhabitants a furnace in which rubbish is burned every evening. In smaller villages, burial of this rubbish in ditches covered with 50 centimeters of earth, tamped down hard before nightfall. In each village, native agents are charged with the duty of collecting rubbish and of burning it or burying it, as the case may be. The performance of these agents is checked by patrols of mobile supervisors. Brush is cleared around the villages on a perimeter of 300 meters kept absolutely clear of all vegetation. Rats hesitate to enter such uncovered spaces, because they are easily seen by dogs that pursue them. Destruction of rats in burrows by means of sulfur dioxide. In all villages inhabited by Europeans, obligation to use rubbish receptacles with a hermetic cover; pick-up and incineration of this rubbish every day.

Epidemiological observations made in Senegal have allowed us to determine that in a number of cases interhuman contagion is made from man to man by means of fleas other than cheopis which swarm in the native huts. In order to fight against these insects and to reduce their number, the Health Administration has made it mandatory to install every evening in every hut a "flea trap", a simple dish filled with oil in which a lighted wick is soaked. The dish is arranged in such a way so that its edges are level with the ground. The fleas, attracted by the light, jump up and are burned or drown in the oil. In some huts several hundred insects a night were captured with these simple traps. The native agent of the Public Health service is required to check in the evening that the traps are really set up in each hut. A total credit of more than two million francs had been assigned to carry out these measures.

No doubt that such detailed precautions contributed effectively to the considerable decrease in plague cases in 1931 in comparison with 1930. Did the vaccinations also have something to do with this? A question to which it is quite difficult to reply precisely. Nevertheless, the following statement that I borrow from the report of Surgeon General Soral, Director of the Health Service of West Africa (*Directeur du Service de Sante de l'Afrique Occidentale*), seems to allow us to conclude that the share of vaccinations in this improvement is quite minimum, if

it exists at all.

For various reasons, the prophylactic measures that were applied so firmly in the endemic area of Senegal could be applied only incompletely and laxly in the city and district of Dakar that forms an administrative region distinct from the rest of the Colony.

Now, in Senegal:

population . . . . .	400,000 inhabitants
vaccinations . . . . .	403,770
cases of plague . . . . .	426, with 223 deaths

In the Dakar district:

population . . . . .	54,000 inhabitants
vaccinations . . . . .	42,114 (figure stopping 31 July)
cases of plague . . . . .	459, with 332 deaths

Therefore, for a population seven to eight times smaller, about thirty more cases, although the number of vaccinations seems to have been proportionally equal, for it is well to note that the figure of 42,114 vaccinations for Dakar does not include the ones in August, September and October, a period during which the operations continued.

It is very difficult to draw conclusions from all the reports received from Senegal. Certain facts tend to prove that the vaccine has only a very problematic efficacy.

For example, in the village of Camberene, of a population of 872 inhabitants, 121 cases of plague occurred, of which:

62	in persons definitely vaccinated
52	" " doubtfully "
7	" " definitely not vaccinated

In the Medina School, a teacher who had had himself vaccinated at the head of his class, in order to set an example for his pupils, died four months later; six of them, also vaccinated, suffered the same fate.

It is not amazing, after such striking examples, that the inhabitants, both in Senegal and in Madagascar, have no faith in vaccination and rebel against it, even in the most favorable environments for our preventive methods, above all when the natives have been able to observe, a disturbing coincidence, that some villages in the outskirts of Dakar where the inhabitants had shown themselves to be particularly rebellious to vaccination were practically spared.

Surgeon General Sorel comes up with a hypothesis: he says that too often the vaccinations are administered by native physician's aids with a faulty technique. First of all, they forget to shake the vaccine ampules sufficiently to cause a homogeneous distribution of the microbes in suspension in the liquid. They omit a massage of the injected area, in order to break the continuity of the path opened by the needle whose caliber for oily injections is 1 mm. 5, which lets part of the liquid come out again. The native himself may exercise pressure in order to force out part of the vaccine in which he has not faith at all.

He mentions the following fact in support of this hypothesis: In the Tivaouane and the Mont Rolland area, all vaccinations were administered personally by the same European physician.

Of a population of 77,000 inhabitants, 48,887 were vaccinated, 28,000 not vaccinated (approximately), or about 2/3 vaccinated and 1/3 not vaccinated.

From 1 January to 1 September 1930:

In 48,887 persons vaccinated, 151 cases, or 0.3%. In 28,000 persons not vaccinated, 374 cases, or 1.03%. 47% deaths among those vaccinated: 60% among those not vaccinated.

These results seem to give the vaccinated persons a certain advantage of protection, not very high, however,

Finally, in Senegal, as in Madagascar, vaccination has shown itself to be powerless until now to rid the country of the plague.

#### Conclusion

What conclusion is to be drawn from the documents that I adduce and from documents that our colleagues gave us in the October meeting?

Dr. Kaneilly says, in a memorandum transmitted by His Excellency Shanin Pasha, that in Egypt there are mildly positive indications of protection of uncertain duration, with vaccination consisting of more than one injection and with doses of at least three billion bacilli. It is not advisable, in his opinion, to count entirely on vaccination in combatting plague.

Vaccines used: vaccine of the Hoechst Laboratories (Germany) or of the Lister Institute (England). These two vaccines are derived from cultures on gelose, sterilized by heating or with an antiseptic, after dilution in the physiological solution. This vaccine is very similar, consequently, to the ones used in the French colonies.

The vaccines used in Morocco are the same as the ones used in the other French colonies. Mediocre results.

Mr. Lutario informs us that in Italy there are almost negative results in the use of the vaccine prepared in the following manner:

"The germ used is a strain of plague bacilli isolated in Naples in November 1929 in a patient. Its virulence, tested on guinea-pigs, was average.

"The vaccine is prepared with cultures on gelose for 48 hours at 29°C. The layer of microbes is collected by washing the surface of the medium with a physiological solution, in an amount sufficient to remove it completely. Then the germ is killed in this suspension by adding five parts in a thousand of formol that is left to act for several days in an incubator at 37°C. When checks made show that the germ is dead, the dense suspension is diluted with the physiological solution until a titer of two billion germs per cubic centimeter is obtained. Then the vaccine is ready for use and no other antiseptic is added to it.

"The recommended vaccinal dose is two injections of one cubic centimeter each spaced five to seven days apart, depending on the reaction. Thus the total vaccinal dose is four billion germs."

Therefore, on the whole, with vaccines prepared almost identically, using cultures on gelose, whether they are derived from Yersin's bacillus or from the bacillus of Vignal and Malassez, whether they are killed by heating or with formol, the results are not very conclusive. The least that can be said of them is that the protection that they afford man against the plague is quite subject to chance.

To my knowledge and according to information provided by our colleagues, only one country at present uses a vaccine derived from bouillon cultures of Yersin's bacilli: British India. The numerous documents provided by that country and particularly the interesting general report made by Major General Graham are rich in particularly conclusive facts on the high rate of protection offered by Haffkine's vaccine. ([Note:] See Bulletin de l'Office International d'Hygiene publique, Vol XXIV, 1932, p 447.)

Major Anderson, Director of the Haffkine Institute in Bombay, has given us an accurately detailed account ranging from the preparation of this vaccine, from the care taken in selecting the strains, to the evaluation of their virulence and to the determination of the degree of protection afforded by the vaccine against the experimental infection of laboratory animals (Ibidem, p 459).

If I compare the results achieved in India with those that I mentioned initially concerning the use that has been made in India-China of Haffkine's vaccine from 1908 to 1915 which allowed us to observe an appreciable decrease in mortality among vaccinated persons (57% against 97%), I am led to conclude that to date this vaccine appears to be the most effective one in the practice of human prophylaxis of the plague.

Last October the results already achieved in the inquiry initiated by the International Office of Public Health impressed the Office of the Inspector General of the Health Service of the Colonies (Inspection Generale du Service de Sante des Colonies). Instructions were sent to the colonies concerned so that each lot of different vaccines received would be tested, before using them, on laboratory animals and so that any batch whose immunization power did not reach 30% against a definitely mortal plague dose would be rejected.

In December, a physician who is especially expert in the preparation of antiplague vaccines was sent on a mission to Senegal to conduct experiments on the spot in collaboration with the personnel of the Dakar Pasteur Institute.

These experiments have shown:

that the mixed lipovaccine (Yersin's bacillus and PST bacillus) protected, in a proportion of 60% to 70%, the Senegalese gray mouse against a dose of plague bacillus about ten times mortal;

that, under the same conditions, the PST vaccine of the Pasteur Institute protected in the proportion of 51%.

On the other hand, the Paris Pasteur Institute, has prepared, in accordance with Haffkine's method, a vaccine using the PST bacillus. Ten thousand doses of this vaccine have been sent to Madagascar and will be immediately tested experimentally.

.. END ..