

aining foods such as meat and meat extracts and glandular organs are eliminated from the diet for at least six to twelve months. The return to an ordinary diet depending greatly on the general condition of the patient.

### Drugs

Some form of Salicyclic Acid is employed. Salicylate of soda or Aspirin may be given in large doses (20-30 gr. 3 hourly), and the ill-effects of these large doses, Salicylism (symptoms of which are dizziness, noises in the ears, vomiting and acidosis) may be partly counteracted by giving alkalis such as sodium bicarbonate with the salicylates.

A daily evacuation of the bowels should be maintained by means of simple purgatives, e.g., Vegetable Laxatives, Cascara Evacuant and Infusion of Senna. Drastic purging and straining must be avoided.

In convalescence iron tonics are often given for the anæmia which frequently follows the disease.

### HAFFKINE'S PLAGUE VACCINE

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From an article by Lt.-Col. S. S. SOKHEY, M.A., M.D., I.M.S.,  
Director, Haffkine Institute, Bombay.

Dr. Waldemar Mordeci Wolff Haffkine came out to India, in 1893, as a voluntary worker to test in the field the encouraging laboratory results he had obtained with his prophylactic inoculation against cholera. Prior to coming to India, he had, for eleven years, been working in the Pasteur Institute, Paris, which during that period has been the scene of the epoch-making discoveries of Pasteur on the subject to prophylactic inoculation against infectious disease.

He was very successful with his cholera vaccine in reducing both the attack rate and the case mortality of the disease. He was still engaged in these investigations in Bengal when, in September, 1896, the outbreak of bubonic plague occurred in Bombay which was the starting point for the spread of the disease throughout India. The Government of India sent him to Bombay to investigate the cause of the outbreak and to devise, if possible, some method of dealing with the disease similar to that which had so impressed them in the case of cholera.

He arrived in Bombay on October 7, 1896, and began his work the very next day in the Petit Laboratory of Grant Medical College. The accommodation provided for him consisted of one room and a corridor. His laboratory equipment was of the meagrest, and his staff consisted in all of one Indian clerk and two peons. Still such was the genius of this great Russian that in no longer than three months he had evolved and tested experimentally his vaccine, which in its general lines remains unchanged to this day. On January 10, 1897, he demonstrated the harmlessness of the vaccine by injecting into his own body 10 cc. of the product.

Soon after Haffkine had an opportunity of demonstrating its value in protecting individuals definitely exposed to risk of plague infection. An outbreak of plague occurred in the House of Correction, Byculla, and half the inmates of this jail were inoculated and half kept as controls. Amongst the 148 inoculated only two cases of plague occurred, neither of which was fatal, whilst amongst the 172 uninoculated prisoners there were twelve cases with six deaths.

On the publication of the results of this trial there was an immediate demand for inoculation, and the demand has been growing with the increasing recognition by the health authorities and the public of the value of the vaccine as a preventive measure. An analysis of carefully kept records of inoculation shows that during an epidemic there are about three times fewer attacks of plague in the inoculated than among the uninoculated; and among plague patients the number of deaths in those who have undergone inoculation is about half as compared with the mortality amongst the uninoculated patients. The final result is that during the prevalence of plague the number of deaths in the inoculated is about one-sixth of that among the uninoculated living in the same infected locality. This is a very high degree of protection.

#### **Animal Experiments**

That the vaccine does not save all the inoculated does not seem to be entirely the fault of the vaccines. For when experiments are carried out with laboratory bred animals whose state of nutrition is under control and therefore of the very best, it is found possible to save with the vaccine cent. per cent. of the animals against an infecting dose of plague so large that all the uninoculated animals are killed by it. The significance of these experiments is still further heightened when it is realised that the animal used for these experiments is the white mouse, the animals most susceptible to plague infection; only 3-10 organisms being enough to kill it. This crucial experiment, which can be repeated at will any number of times, is conclusive proof of the value of Haffkine's plague vaccine. And there can be little doubt that if the masses of India were as well nourished as the laboratory animals, Haffkine's vaccine would save still more lives. Sir John Megaw's memorandum on the state of nutrition of the masses of India must be fresh in every one's mind.

Plague is a disease of rat, and is only accidentally communicated to man by rat fleas. As long as there are rats there will be plague, and man will run the risk especially if his habitations are of a type easily infested by rats. Even though Haffkine's plague vaccine gives a high degree of protection against an attack, it is no permanent solution of the difficulty. Other methods especially the destruction of rats and erection of houses of materials and designs that would not lend themselves to rat infestation are of the utmost importance.

Carefully planned animal experiments conducted at the Haffkine Institute have shown that only 0.007 to 0.03 cc. of Haffkine's vaccine is required to save a white mouse against plague while almost 1.0 cc. or more of other plague vaccines is needed. These experiments show

Haffkine's vaccine to be 30 to 140 times more powerful. It has also to be remembered that the recommended dose of Haffkine's vaccine is 3 to 4 cc. while that of other vaccine tested is only 1 to 1.5 cc. There are several possible reasons why Haffkine's vaccine is superior to other plague vaccines; the principal being that the plague germs from which the vaccine is made are very virulent and are obtained from cases in India.

All are familiar with the fact that persons seldom suffer from two attacks of certain diseases such as smallpox, typhoid fever and plague. One attack of the disease protects the patient from another attack of the same disease; nevertheless the protection so acquired is not absolute. Dr. Jenner was the first to show that protection from smallpox could be acquired by inoculating a person with a modified form of the disease known as cowpox. The vaccine used by Jenner was however a living virus. Since then it has been found that in the case of bacterial diseases such as plague, typhoid fever and cholera, a living vaccine is not necessary, the introduction of dead bacteria of the disease under the skin is enough to stimulate the body to produce protective substances against an attack of the disease. Haffkine's vaccine is a culture of the plague bacillus which after being grown in broth for a period of four weeks is killed by heat and to which 0.5 per cent. carbolic acid is added.

#### **Manufacture**

The first step in the preparation of the vaccine is the preparation of a liquid nutrient medium suitable for the growth of plague bacillus. This is done by digesting goat flesh or wheat flour with hydrochloric acid at 70° centigrade for 3 days. A clear amber-coloured liquid results and is distributed into four litre flasks of a special shape and is sterilised in steam at 15 lbs. pressure. Into this medium in flasks is added the plague germ and allowed to grow at room temperature for 4 weeks. A great deal of care has to be taken to ensure the suitability and purity of the plague germ isolated for the purpose from the blood or the bubo of patients suffering from plague.

At the end of four weeks of growth a small amount of the product is removed under special precautions from each flask and is tested for absolute purity by suitable methods. Flasks found to have a pure growth are passed on to another department where the growth is killed by heating the flasks at 55° centigrade for 15 minutes in water baths. Then 0.5 per cent. carbolic acid is added to each flask. The vaccine is now ready and is filled into special shaped ampoules and hermetically sealed. After the ampoules have been filled and sealed two ampoules from each batch of 35 are opened under special precautions to test their absolute sterility. It is only after the product has undergone these rigorous tests that it is allowed to go out of the institute.

It is not always possible to get patients suffering from plague. Therefore the plague germ when once obtained is kept alive and in good condition by passing it by inoculation from rat to rat or by growing it on a special solid medium and storing it in cold.