

and again I should like to emphasize the necessity for this in regard to typhoid or any vaccine, for the purpose of insuring subsequent sterility. One would be a criminal if one did not send out sterilized vaccine; but you cannot make it remain sterilized in other hands unless antiseptics are added. There are only too many instances where this has been neglected. A plague vaccine in India became infected with tetanus germs with terrible results.

Scarcely less important is the question of standardization. We standardize our vaccine by counting the bacteria. With our present knowledge that is the most effective way in which we can proceed. An ideal method of standardization is not yet discovered. We carry out our method the best we can in regard to technique and by observing every possible similarity and detail. We use the same strain and count the germs so that we shall get the same results with regard to reaction and with regard to protection in the successive batches of vaccine prepared for us. Beyond that, however, one cannot go, for though we standardize the vaccine we cannot standardize the person we are going to vaccinate. Different individuals differ very much in individual susceptibility. We cannot, I think, advise especially further precautions, such as analyzing the blood of the individual to see if he is especially susceptible to virus or not. From my own experience, I am led to the conclusion that when an individual shows exceptionally severe reaction to vaccine, that individual is not so likely to be effectively protected as one who shows ordinary reaction. Indeed, he is more likely, if exposed, to contract the disease. I have seen cases in which this has been well shown, as in the case of a British officer who had a very severe reaction, and subsequently, within a year or eighteen months, had a very severe attack of typhoid in Africa. He nearly died, and two years afterwards he had another attack of enteric. In the other case this vaccination would probably have done good. He was very susceptible to typhoid bacillus, whether they were dead or alive.

We employ in our dosage two successive inoculations; first a dose of five hundred million bacteria; second, double that, or one thousand million. We separate these doses by an interval of ten days. This interval is not fixed haphazard, but is the result of careful experiment, which has shown this to be the most suitable length of time between two doses. A third dose would be better, possibly four would be better than three, but in the army there are reasons which make it impossible to go beyond two doses. In the American army, where they have had the good sense to adopt the compulsory system, they tell their men they have to have three doses.

Following the question of dose is the question of reaction. The vaccine is given by a hypodermic injection, and results in an area of tenderness and redness about three inches in diameter, about the site of introduction of the needle. This is sometimes painful and generally tender on pressure. This local reaction reaches its maximum in eighteen to twenty-four hours after inoculation, and then subsides. There is nothing like the disturbance which follows an ordinary vaccination against smallpox. In exceptional cases the glands of the axilla become slightly enlarged and the lymphatics injected, but this generally subsides rapidly.

The symptoms of the constitutional reaction are fever, and sometimes a certain amount of nausea and general feeling of malaise. The fever rarely exceeds 101 degrees, the average is a fraction over a hundred, and a large percentage of inoculated individuals show no temperature at all. There are, however, cases which show a much more severe reaction than that and where the temperature may rise to 102 or over and the individual feel out of sorts for perhaps three or four days.

In several hundred thousand inoculations, which have been done with our vaccine, I am glad to say no dangerous results have been reported and no deaths. It is a perfectly safe procedure, even if reaction is sometimes severe.

In connection with this question of reaction, there are a great many other typhoid vaccines than the one devised by Sir Almroth Wright and improved by myself and my colleagues. This is only one, but it is the pioneer, the one which in early days was employed most largely, and is the parent of the one now used by our colleagues of the