PLAGUE VACCINES

A report on living antiplague vaccines (virus-vaccines) was presented at the Fourth Congress of Tropical Medicine by Dr. Georges Girard, Chief of the Plague Service of the Pasteur Institute of Paris and former Director of the Pasteur Institute of Madagascar.

Since 1934, living vaccines have replaced killed vaccines in the immunization of man against plague in Madagascar and Java.

Having observed that, while killed vaccine was ineffective, a single dose of E. V. virus-vaccine produced a solid and lasting immunity in the guinea pig, Girard and Robic carried out inoculations of the same vaccine in man in Madagascar in 1932-1934. Otten made similar observations at the same time in Java with the Tjividej strain. Differences in immunizing power of these two strains led to the hypothesis that there are at least two antigens in these virus-vaccines, one active for the guinea pig, the other for the rat. The practical conclusion is that, for man, a combination of both strains would be desirable.

A living plague vaccine must be innocuous for man, but this can be demonstrated only in man. It need not be devoid of all pathogenic power for animals in order to be harmless for man. Only by animal inoculation can a virulent strain be distinguished from an AVIRULENT strain. So-called AVIRULENT strains are merely strains with weakened virulence. The virulence may vary according to the animal used, the method of inoculation, and the dose. The antigenic properties may become less, but under natural conditions never become greater. An avirulent strain may have no antigenic power. Each strain has its own individual behavior on this point. There is no sure-fire method for obtaining a stable virus-vaccine from a virulent strain. Various methods require varying lengths of time.

To be effective for man, a virus-vaccine must have the following characteristics: maintenance of a certain degree of virulence for the guinea pig and persistence of the toxicity of the microbial bodies. Any plague strain to be used for human inoculation must be subject to regular control. Conservation on nutritive gelose, at 2-4°, with annual reinoculation has been successful for the E. V. strain. Its characteristics have remained intact for fourteen years. Passage through the guinea pig, with seeding of the tissues of certain organs, will serve for occasional reinforcement of antigenic properties.

A living vaccine must be prepared as needed and cannot be stocked. Because of the importance of inoculating the maximum of viable bacteria, the period of validity has been fixed arbitrarily at one month, provided the ampoules are kept under refrigeration. The bacterial content may vary widely according to the strain used. A single dose of one cu. cc. is inoculated. Because killed vaccines can be stocked and quickly controlled, virus-vaccines should be reserved for strongly endemic areas with annual epidemics, where effective etiological prophylaxis is impossible. Mass vaccinations with virus-vaccine reduces morbidity by 80%. A booster inoculation is advised before the annual epidemic; protection is acquired on the fifth day and is not preceded by a negative phase. No accidents have been reported; reactions are slight.

Over seven million human inoculations have been done in Africa, Asia, and the U.S.S.R. with various avirulent strains. Several strains have been studied in Madagascar and Java and others are now being studied at the G. W. Hooper Foundation.

The reactions produced in animals by living vaccines indicate that the process of immunity in plague is cellular rather than hormonal. This is supported by work done on the defense mechanism of the lung following inhalation of virus-vaccines, which also suggests the possibility of a more effective protection against plague pneumonia. Work in progress on the antigens of *P. pestis* and the isolation of several fractions, one of which protects the guinea pig, may lead to greater choice of vaccinal strains, and, perhaps, to eventual substitution of chemical antigens for the present vaccines. Until then, virus-vaccine represents a proved method of plague prevention which has already spared many lives in Africa and Asia.