Poliomyelitis Vaccination

The achievement of the new poliomyelitis vaccine is truly a great story deserving the full play it has received in the newspapers. It is one of the great public health events of the mid-century. It represents a triumph of basic research and an amazing example of effective teamwork.

The details of the evaluation of the 1954 field trial of the Salk vaccine, reported at the University of Michigan, April 12, have been adequately covered by the press. So I thought it would be more interesting to trace some of the scientific problems that had to be solved in the course of achieving a poliomyelitis vaccine and to attempt to outline some of the future developments and problems.

Until quite recently no coherent theory of the disease was established. The scientific basis for an effective means of immunization or control did not exist. Many facts were known, but they were separate pieces of a jigsaw puzzle that did not seem to fit together. For example, early epidemiological studies 50 years ago led to the inference that there were 100 persons infected for each one paralysed, but it was not until 1940 and later that this thesis was proved in the laboratory. The age distribution of cases, resembling that of measles, led to the inference that immunity followed an attack, but there were disconcerting numbers of bona fide instances of double attacks of the paralytic form of the disease. This cast doubt on the immunity mechanism.

Presented is a summary of Dr. Alexander D. Langmuir's informal remarks before the meeting of the Departmental Council of the Department of Health, Education, and Welfare, April 14, 1955. Dr. Langmuir is chief of the Epidemiology Branch, Communicable Disease Center, Public Health Service.

For many years it was believed that the virus had a peculiar predilection for nerve tissues. This belief led to the study of nasal sprays in an attempt to "block" the supposed pathway to the brain along the olfactory nerve. The treatment caused a lot of people temporarily to lose their sense of smell but did not prevent poliomyelitis.

Careful search for the virus in the blood failed to reveal its presence there with sufficient consistency to support the conclusion that blood was the mechanism for transfer of the virus to the brain.

In the laboratory for more than 30 years, the only animal susceptible to the infection was the monkey. In 1939, Dr. Charles A. Armstrong of the Public Health Service announced the isolation of the Lansing strain in mice, but this culture turned out to have so many peculiarities that some persons doubted for a time that it was truly a poliomyelitis virus. Tests for immunity to poliomyelitis viruses were very difficult, expensive, and often so inconsistent as to result in continued confusion.

In the field, epidemiological studies also left many points uncertain. The isolation of the virus from feces led many workers to think of the disease as comparable to typhoid. Later, the discovery of the virus in flies led to extensive attempts to control epidemics with DDT. The exact route of infection from one person to another remains in doubt, but increasing evidence points to the similarity of this infection to the other classical contagious diseases such as measles, chickenpox, and mumps.

In the solution of these problems, certain major "breaks" in the form of new discoveries and contributions to basic knowledge deserve special mention.

In 1948, Drs. Howard A. Howe, David Bodian, and Isabel M. Morgan, at Johns Hopkins University, were able to define the immu-

nity mechanisms in poliomyelitis by using large numbers of monkeys almost to the degree that other laboratories might use mice or guinea pigs. The availability of such numbers of monkeys was, of course, one of the brilliant contributions of the National Foundation for Infantile Paralysis. It was shown that three distinct types of poliomyelitis existed, each separate from the other. One of these types was the Lansing strain isolated by Dr. Armstrong. The existence of these three types adequately accounted for the occurrence of double attacks of the disease. A comparable experience is that one can catch German measles independently of true measles. The discovery of the three types of poliomyelitis and the existence of an immune mechanism similar to other diseases strongly suggested the possibility of a vaccine and indicated that all three types of virus would have to be included in it.

In 1949, Dr. John Enders at Harvard University announced the cultivation of the poliomyelitis virus in human tissue cultures. Later it was possible to grow the viruses abundantly in monkey tissues. This discovery made possible the production of the large quantities of virus, free of undesirable brain tissue, that would be necessary for a national supply of vaccine.

In 1951, when many workers were still thinking of poliomyelitis as primarily a disease of nerve tissues, Dr. David Bodian at Johns Hopkins and Dr. Dorothy M. Horstmann at Yale University simultaneously announced the discovery of the virus in the blood stream of monkeys and later of man. The key to this fundamental discovery was looking for the virus at the right time, namely, before symptoms developed rather than after the disease was in full swing. This discovery further gave promise of the probable effectiveness of a poliomyelitis vaccine because immunity in the blood would eliminate virus and probably prevent it reaching the nervous system.

In 1952, Dr. William Hammon at the University of Pittsburgh reported his successful studies of gamma globulin. These further supported the concept that a vaccine would be successful.

Thus, only in the last 3 to 4 years has a coherent theory of the disease been developed and have the technological tools become available to permit in humans large-scale tests of vaccination against poliomyelitis.

In developing the actual vaccine, Dr. Jonas E. Salk of the University of Pittsburgh has been the extremely able executor of all this basic scientific development over many years in many laboratories. As he most aptly stated recently, "Dr. Enders threw a forward pass and I happened to catch it." He is an accomplished runner.

The Public Health Service is proud to have had the opportunity of participating in the vaccine evaluation by assigning Epidemic Intelligence Service officers to Dr. Thomas Francis' laboratory and to the collaborating States and research laboratories. They have been some of the soldiers on the team—doing much of the legwork in collecting basic records and specimens. They have contributed considerably to the accuracy and completeness of the data and thereby to the confidence in the conclusions that have been reported.

The Biologics Control Laboratory of the National Microbiological Institute, National Institutes of Health, worked closely with Dr. Salk and the participating pharmaceutical houses in developing standards for the vaccine. This laboratory, along with the NIH Rocky Mountain Laboratory at Hamilton, Mont., and the Virus Laboratory of the Communicable Disease Center, located in Montgomery, Ala., also participated in the vaccine evaluation.

I expect widespread acceptance of the vaccine this year. A rapid decline in the disease can be looked for. As yet it cannot be concluded whether the virus will disappear from the Nation or whether the infection will continue to spread among the population without causing paralysis in immune persons. If the infection progressively disappears, as I believe it will, then it will be necessary to immunize only a substantial number but not all susceptible persons in the population. If the virus continues to spread, then it will be necessary to exert particular effort to immunize 100 percent of the population, including adults. In either event, the supply of vaccine should become sufficient and the essential elimination of the paralytic form of the disease can be predicted with assurance.