

# Smallpox showed the world the way

by John F. Wickett



Have you been vaccinated? Have your children been vaccinated? Value for money, it is probably the best health investment you can make.

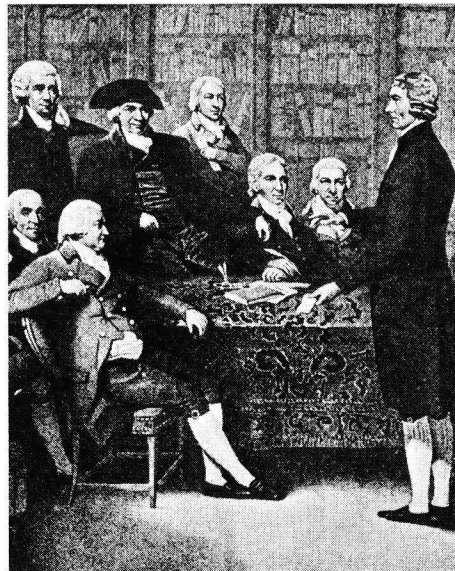
It is a little misleading, perhaps, to class smallpox eradication as a successful "immunization programme," because today's immunization programmes, to be successes, must be continuing and permanent features of the health system. Nevertheless, smallpox represented an unprecedented success as an eradication programme during the 13 years from 1967 to 1979 when the disease was totally eliminated.

People surely welcomed the chance to avoid smallpox when Edward Jenner, an Englishman, first demonstrated vaccination in 1796. He died a rich and honoured man. Smallpox was a horrifying disease, with no effective treatment once you got it and a more than one-in-five chance of dying. In fact, people were so afraid of it that they practised "inoculation," taking some matter from a pustule of a smallpox victim and placing it in a scratch on the arm of a healthy person in the hope of getting only a mild case; they knew that once you contracted the disease you were protected from getting it a second time. The chances of getting a full-blown case and dying were less... but not negligible.

Jenner discovered that "inoculating" people with pus from an infection on the teats of cows (cowpox) protected them from smallpox with no risk. To distinguish his method from "inoculation" he called it "vaccination", derived from the Latin word for cow. At the time people did not know why vaccination worked, only that it did. Subsequent investigation of this

phenomenon led to the science of immunology that we know today.

The French scientist Louis Pasteur, paying homage to Jenner's breakthrough in London in 1881, proposed that the word "vaccination" be extended in meaning to cover all forms of active immuniz-



*Edward Jenner (1749-1823), discoverer of smallpox vaccination and the father of immunology. He is shown here (at the rear, holding a paper) listening to an address by the founder of the Medical Society of London, John C. Lettsom. It was Lettsom who first sent samples of Jenner's new-found vaccine overseas to the United States.*

Contemporary drawing from the Medical Society of London.

ation. Thus we now speak of polio vaccine, measles vaccine, and so on even though none of them has anything to do with a cow.

Jenner's discovery of vaccination eventually resulted in the global eradication of smallpox—something he himself predicted at the time. But he might well have wondered

why it took so long; 181 years elapsed between his discovery in 1796 and the occurrence of the world's last endemic case in 1977. On the other hand, mounting a worldwide vaccination programme was hardly a small undertaking.

As recently as 1959, it was still believed that if each country simply staged vaccination campaigns reaching 80 per cent of the population, smallpox would be eliminated. In that year, WHO's World Health Assembly passed a resolution urging countries to do just that. While the proportion of the world's population living in endemic areas decreased from 59 per cent in 1959 to 30 per cent by 1967 and the number of countries with endemic smallpox fell from 59 to 31, this could hardly be considered effective control, much less eradication.

The approach to the problem needed serious revision. In 1966, WHO decided to actively promote and coordinate the eradication of smallpox, and it voted a specific budget allocation for staff and for material assistance to countries. The Intensified Smallpox Eradication Programme started in 1967.

Every disease has certain weak points susceptible to attack. On the positive side in the combat against smallpox, freeze-dried vaccine was stable even in hot climates, gave long-lasting protection and was easy to administer. Moreover, the disease occurred only in humans. On the negative side, in 1967 a lot of vaccine being used was not up to required standards of potency and stability, and the health infrastructure of many countries was insufficient to mount a countrywide campaign. Furthermore, even 80 per cent vaccination coverage of the population could not eliminate smallpox in densely populated areas.



*An Ethiopian surveillance worker recording a case of smallpox in the early 1970s. As recently as 1967, smallpox was still endemic in 31 countries. The last case in the world occurred in neighbouring Somalia, in 1977.*

Photo WHO/P. Almasy

The essential ingredient was the intervention of an independent, international mechanism to coordinate matters. WHO organized the supply of vaccine through voluntary donations, the support of national vaccine producers and, most importantly, the establishment of international reference centres for

independent quality control of the vaccine. And it provided funds which helped countries to pay for vehicles, fuel and maintenance.

Fundamental to the eradication of smallpox was the strategy used in areas with high population density. The virus which causes smallpox can only live in a human host, is not infective unless the victim has overt symptoms, and is transmitted relatively slowly from person to person by the respiratory route, like a cold. Thus in sparsely populated areas it tended to die out as it ran out of fresh victims. In densely populated areas it was not necessary to have a high overall vaccination coverage, but rather 100 per cent coverage in the immediate vicinity of a case. This was achieved by surveillance-containment, that is, quick recognition of a case, isolation of the case, and 100 per cent vaccination of everyone who could have had contact with the victim. It was this surveillance-containment strategy which finally resulted in eradication, rather than a mass-vaccination campaign.

If smallpox eradication can be thought of as an international effort of fixed duration, a worldwide im-

munization programme must be thought of as a permanent system and infrastructure for regularly immunizing children. Experience in the smallpox programme showed what a formidable task this could be. Nevertheless in 1973, only six years after the start of WHO's Intensified Smallpox Eradication Programme, the first meeting of the Committee for the WHO Expanded Programme on Immunization took place, and EPI was born.

The total international investment for smallpox eradication is estimated to have been no more than US \$200 million, 1967-1979. The savings, in 1979 terms, from being able to stop routine vaccination are estimated to be over \$1000 million per year. If the returns on EPI are less easily calculated and not so immediately spectacular, they are enduring. Ask any child. ■

*A general vaccination day at the Paris Academy of Medicine in 1870. Vaccination is being done directly from the cow. Engraving from the National Library of Medicine, Bethesda, USA.*

