Only two years after the world's last case of endemic smallpox occurred in Somalia, in October 1977, WHO was able to make the official declaration of global smallpox eradication. Throughout this period a continuous search was undertaken for possible hidden cases in the areas where the disease had previously been endemic.

This thorough and comprehensive search relied heavily on laboratory investigations of all suspect cases, since it was often only the laboratory that could show whether the disease was smallpox or not. Thousands of such investigations were carried out on smallpox suspects from dozens of countries at the two institutions supremely qualified in the laboratory diagnosis of pox infections, namely, the WHO Collaborating Centres in Moscow (Moscow Research Institute for Viral Preparations) and in Atlanta, USA (Centers for Disease Control). These investigations gave negative results for all suspected cases: not a single case of smallpox has been revealed.

The data obtained provided the major premise that enabled the Global Commission for the Certification of Smallpox Eradication, which had been created by WHO, to confirm that the whole planet was "clean". In the Commission's report, recommendations for the post-eradication era occupy a special place, because of the need to give the public evidence that smallpox will never reappear and that mankind is not endangered by other poxviruses.

Laboratory work combining both diagnosis and research formed a substantial element in this post-eradication surveillance programme. The diagnostic part was in effect a continuation of similar work carried out during the closing stages of the eradication campaign, when it related to patients suspected to be smallpox cases.

In the past decade we at the Moscow Collaborating Centre were involved in investigating rumours about smallpox, some of which reached the press and thus aroused the natural concern of the public. In all these cases, WHO was eager to obtain from the collaborating centres the results of laboratory study of materials taken from the patients in question. To our general satisfaction, the rumours have never been proved true.

It is appropriate here to make a small digression. During the campaign the laboratories performing the diagnostic work that was needed in order to identify new viral isolates used to use laboratory strains of the variola virus. At our laboratory and elsewhere, the peculiarities of variola virus strains isolated in different geographical regions were studied. This work not only enlarged our knowledge of the variola virus but also made it possible to explain the difference in the clinical course of the so-called "Asian" smallpox and "African" smallpox. The research undertaken in other laboratories involved a comparative analysis of variola and other orthopox (especially monkeypox) virus genomes. As a result of this long-term work with variola virus, a vast collection of its strains was gathered in some laboratories. After smallpox transmission stopped, the stocks of strains preserved in laboratories turned out to be a real potential hazard for the reappearance of smallpox.

The small number of laboratory-acquired smallpox cases testify to the fact that work with variola virus without appropriate precautions always presents a danger for those who handle it as well as for other people. A threatening reminder was

Sealed refrigerator at the WHO Collaborating Centre in Moscow where variola virus strains are stored. Besides a lock and a seal, it is fitted with a sound alarm.

Photo WHO/S. Marennikova
The tragic episode that occurred in 1978 in Birmingham, England, when a woman working one floor above a laboratory where variola virus strains were being studied contracted smallpox and died. Her mother, too, was infected but recovered.

The abandonment of vaccination after smallpox eradication naturally increases the risk of infection spreading if the virus ever escapes from a laboratory. That is why WHO has undertaken a complex of measures to exclude such a possibility. The first step in this direction was to reduce the number of laboratories maintaining variola virus strains. This process started even before the campaign was completed. In 1976 there were 76 such laboratories, but today there are only two, both acting as WHO Collaborating Centres.

Besides this, in 1977 WHO began to develop biological safety requirements for laboratories dealing with or preserving variola virus. After some improvements, these requirements provided appropriate safeguards both for people handling the virus and for those in the vicinity. WHO inspection teams regularly check that these requirements and virus storage regulations are fulfilled. It should be added that research into variola virus has actually stopped within the last two years. Now the question arises whether we must continue maintaining stocks of variola virus or destroy them.

A no less important part of laboratory research in the post-eradication era was the study of human monkeypox, a disease “discovered” in Equatorial Africa in 1970. Its striking feature is the similarity of the clinical picture to that of smallpox. This very fact accounts for the close attention paid to this disease and the need for it to be investigated in the framework of WHO project. Some questions still remain to be answered about the development of infection in human beings, the ecology of the virus and the potential danger of monkeypox under conditions of a steadily vanishing immunity to smallpox. As a result of activities organized and coordinated by WHO between surveillance teams in some African countries and laboratory work at the collaborating centres, it has been established that human monkeypox is a rare zoonotic disease, but the geographical area where it can be encountered is a large one and covers the tropical rain forests of Equatorial Africa. Most patients (75.1 per cent) get infected from animals—the natural carriers of the virus. In 18.6 per cent of cases, the source of human monkeypox under conditions of close contact was the infected person (second infection generation). Transmission to the third generation was very rare (less than seven per cent), and only once in 17 years was a fourth generation infection found. Results obtained so far confirm the initial data showing the small contagiousness and transmissibility of monkeypox in comparison with smallpox.

An important step in the monkeypox study was the detection of a natural reservoir of this infection. For a number of years, efforts in this direction failed to give any perceptible results. Only by the end of 1985 did the combined investigations carried out by WHO epidemiologists and virologists from the collaborating centres result in the discovery of the virus reservoir. It turned out to be some species of tropical squirrels.

The long-term (17-year) study of monkeypox isolates obtained from patients in various African countries showed the pathogen to be quite stable and not prone to any substantial variability. However, it seems reasonable to maintain periodical control of the properties of this virus in the future.

Among other orthopoxviruses (besides vaccinia virus), the cowpox virus is pathogenic for humans. During the years of post-eradication surveillance, our knowledge of the ecology of this virus was extended. The most interesting thing here is that we had to change our opinion about the natural reservoir of this infection. It has been proved that the carriers of the virus in nature are small rodents. It also appeared that the cowpox virus possesses a wide range of pathogenicity and can affect individuals of the majority of taxonomic groups of animals. Recently the possibility of human cowpox infection caused by contact with sick rodents was demonstrated. The feature of this infection and its contagiousness has not changed since Jenner’s time, and it is only harmful to human health in special cases, for instance, when it affects the eye.

The overall conclusions of the surveillance and research into orthopoxviruses infections conducted during the post-eradication period are that smallpox itself has completely disappeared and that other orthopoxviruses, including monkeypox, do not present a danger for public health.