On 24 August last year Professor Henry Bedson of the Department of Medical Microbiology at Birmingham University analysed samples from Mrs Janet Parker, a university photographer, and confirmed that she had smallpox. The source of her infection was almost certainly Bedson's smallpox laboratory. Within a few weeks Professor Bedson had committed suicide and Mrs Parker had died. The affair is *sub judice* under the pending court case against Birmingham University under the Health and Safety at Work Act, but despite that Clive Jenkins, leader of the Association of Scientific, Technical and Managerial Staffs last week published his copy of the Shooter report—the confidential government report of the committee of inquiry into the incident. Shooter's indictment is a strong one, and Mr Jenkins believed it in "the over-riding public interest" that he publish it. Here Robin McKie of the *Times Higher Education Supplement*, Mary Lindley, Judy Redfearn and Robert Walgate report.

UK smallpox research could continue at Porton

The unofficial publication of the Shooter report by union leader Clive Jenkins last week is likely to produce swift results in Britain. The recommendation that the nation's only remaining smallpox research unit, at St Mary's Hospital in London, should be moved to an isolated area in the country has already been backed by the local Member of Parliament, Mr Arthur Latham. And the head of the unit, Professor Keith Dumbell, admitted that it would now be impossible for smallpox research to be carried out at St Mary's.

However, later in the week Dr David Simpson, recently appointed director of the special pathogens unit at the Medical Research Establishment, Porton, told *Nature* that he would be willing to receive Professor Dumbell's live smallpox virus at Porton. He could store it there, said Dr Simpson, but he did not want Porton to become "just rent-a-space". Any researcher using Porton in this way would be expected to use and collaborate with Porton staff in research on the material so stored.

Professor Dumbell, on the other hand, believes the scientific case for moving is arguable. "We have in our laboratory all the precautions that we have been able to think up. The chances of a virus escaping are very much smaller than those risks to which we expose ourselves everyday", Professor Dumbell added.

His laboratory was a purpose-built unit designed to cope with smallpox research and took two years to set up. The safeguards—in contrast to the inadequate measures disclosed at Birmingham—include a sealed anteroom; effective laboratory air filtration; antiseptic disposable clothing; a shower room; and regular vaccinations. The move to the country would cost two years' effort that could otherwise be used for smallpox research, he stated.

If the smallpox laboratory at St. Mary's had to close it would be for political reasons, added the school's dean, Dr Harold Edwards. The move to the country would only serve to isolate the smallpox resarchers from colleagues involved in similar areas of work. And Dr Edwards warned that the controversy surrounding the Birmingham smallpox outbreak could lead to growing demands for tighter controls which would diminish the quantity of scientific research in Britain. "The trouble is that increases in controls are not followed by the necessary increases in public funds. Something else has to be taken out of research funds to achieve new safety standards".

Professor Dumbell, who supplied Professor Bedson at Birmingham with 22 virus strains including the one which killed Mrs Parker, admitted there had been a misdemeanour involved when they did not inform the Dangerous Pathogens Advisory Group (DPAG) of the transfer. He thought both of them had assumed the other had notified the group.

Professor Bedson and Professor Dumbell were working on parallel lines of research. At Birmingham, Professor Bedson was using the protein coats of viruses as the basis of an identification process, while Professor Dumbell was attempting a similar technique using the DNA of viruses.

Asked if Professor Bedson could have carried on his work at St. Mary's instead of rushing to complete it at Birmingham, Professor Dumbell said that when the World Health Organisation indicated it was to close down all smallpox research units in Britain, apart from the one at St Mary's, he had been asked by the researchers if he would provide space for them to continue their work. "I answered that I was prepared to do this". □

Professor Keith Dumbell (left) and the sort of facilities at Porton (right) with which he could continue smallpox research.

How the virus escaped

THE Birmingham smallpox laboratory which was the source of the infection which killed Mrs Janet Parker, is a tiny, eight-foot square room in the east wing of Birmingham University's medical school. It is surrounded by a larger room in which experiments on animal pox viruses were performed. Both rooms contain equipment used in normal microbiological research, including safety cabinets with air filters, centrifuges and autoclaves for sterilising gowns and equipment.

The Shooter committee firstly found there was no evidence that Mrs Parker had ever been in the pox virus labora-

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tory suite and they concluded that the virus must therefore have escaped from the smallpox room. The group then discovered that not all smallpox work had been carried out inside the room's safety cabinet and some work with an aspirator to suck off fluid from cell cultures had been undertaken on an open bench.

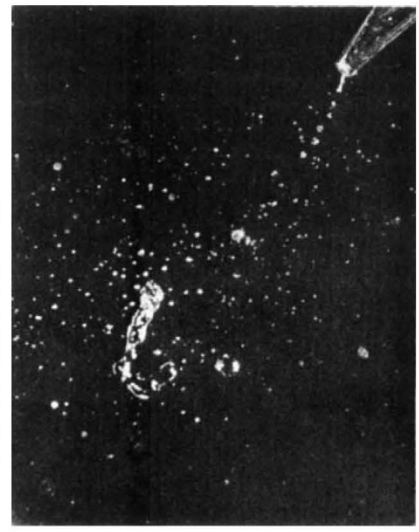
The principal means of transmission of smallpox viruses is probably by aerosol, in tiny droplets of fluid that form when a pipette is used to deliver drops onto a gel or whenever there is splashing of fluid containing the virus. According to Dr Mark Darlow, head of the safety department at the Porton germ warfare establishment for 25 years, the virus is also very stable; so that once airborne it is a potential killer. An efficient air withdrawal and filtration system over any experiment is therefore essential. But many academics still believe that "what was good enough for Pasteur is good enough for me", said Dr Darlow last week.

According to the Shooter report "the opening and closing of the smallpox room door and the passage in and out by whoever was conducting work on the virus would have created the opportunity for any airborne virus to escape into the animal pox room".

The consequent danger was made all the worse because gowns worn in the smallpox room were not removed on leaving.

Even more seriously, the service ducts in the animal pox room and the smallpox room both had gaps which could allow the leakage of viruses. In particular, the telephone room above, which was connected by the duct to the animal pox room, was used frequently by Mrs Parker, when she was telephoning suppliers to order photographic materials. "A check of the orders placed by Mrs Parker during this period reveals that on 25 July she placed an unusually large number of orders. The relevant strain of smallpox virus, Abid, was being handled in the smallpox room on July 24 and 25", the report states.

The committee, although not certain by what route Mrs Parker was infected, concluded that escape via the service duct in the animal pox room was therefore the most probable route of escape of the virus. However, the virus could have reached the corridor outside the laboratory suite and Mrs Parker could have been infected when visiting the inquiry office or the darkroom at the end of the corridor. This was a less likely route, though, and was used by many other persons.



Society for Applied Bacteriology

An aerosol resulting from a bubble burst at a pipette tip when the last drop was expelled. This explains how smallpox virus might have escaped into the air.

And although they could not be certain about the exact route, the Shooter committee was certain that a combination of poor laboratory procedures, amounting to a major breach in containment policy, was responsible for the outbreak. □

All safety nets failed, says Shooter

The report of the Shooter inquiry into the causes of the smallpox outbreak in Birmingham last year finds fault with the three major organisations—the Dangerous Pathogens Advisory Group (DPAG), the World Health Organisation (WHO) and Birmingham University—which were concerned in some way with either running or monitoring the smallpox laboratory at the Department of Medical Microbiology at Birmingham University.

DPAG

The Dangerous Pathogens Advisory Group (DPAG) exists precisely to prevent the sort of event which occurred at Birmingham. It was created in 1975 in the wake of a previous outbreak of smallpox from a laboratory in London in 1973. Shortly after it came into being it began to formulate a code of practice for work with category A pathogens—those recognised as the most dangerous—and to inspect all laboratories known to hold them.

In February 1976, DPAG's inspector visited the Birmingham laboratory. During the time he was there, says the Shooter report, no work on smallpox was being done. He tested the airflow through the safety cabinet and then spent most of his visit talking to Professor Bedson about smallpox work.

The Shooter report criticises the DPAG inspector for not finding out enough about the "range and extent of the work being done". He did not, says the report, "ask about work with tissue cultures"; neither did he ask about the methods of harvesting virus. "These points seem to us to be of considerable importance", the report goes on, "since one of the unsatisfactory features . . . was the necessity to pass in and out of the smallpox room during the course of work with smallpox to place cultures in the incubators and to use the low speed centrifuge".

Despite the fact that the Birmingham lab lacked some of the facilities then recommended for use with category A pathogens, namely an air lock, shower, changing facilities and double autoclave, the DPAG inspector recommended to DPAG that the laboratory be approved. He based his judgement on Professor Bedson's reputation as an "experienced and safety-conscious virologist" and the fact that the few named people working on smallpox always did so under Bedson's supervision. There was also a "highly efficient vaccination programme" in force.

When DPAG came to discuss the inspector's report (it meets twice yearly) it felt that it could use its discretionary powers—granted to it when it was created—to recommend approval of the laboratory to the DHSS despite the shortcomings. It added, however, that "fresh clearance should be sought in the event of significant changes in staff, facilities or work programme".

The committee of inquiry felt that the inspector's report did not give DPAG sufficient information on which to base a recommendation. It criticises DPAG for not insisting on an inspection report that compared the facilities and procedures with those laid out in its own safety code and recommends that in future DPAG inspectors should compare laboratories' facilities against a detailed check list. It also criticises the way in which DPAG exercised its discretionary powers and recommends that in future "discretion should be exercised by DPAG only if alternative arrangements are in force in a category A laboratory which are able to achieve a degree of safety equivalent to that specified in the safety code."

Since the inspection in 1976, says the report, changes had taken place in the smallpox laboratory. Professor Bedson had ceased to do experiments because of other commitments and most of the work had been taken over by a PhD student. This had not been explained to the DPAG inspector. In addition

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