

# **Precautions for Work with Poxviruses that Infect Humans**

## **Policy of the Institutional Biosafety Committee**

### **University of Wisconsin - Madison**

#### Introduction

The purpose of this policy is to provide guidance on appropriate precautions for work with poxviruses that can infect humans. Federal guidance is divided among several documents. The NIH Guidelines, Appendix B, classifies most poxviruses that infect humans, including vaccinia virus, as risk group 2 organisms, which suggests that biosafety level 2 (BSL-2) precautions are appropriate. Monkeypox is designated as a risk group 3 organism and variola virus (smallpox) is risk group 4. Other federal guidance on handling vaccinia virus, however, provides additional information explaining that BSL-2 precautions may not provide adequate protection in the absence of recent immunization for certain strains, and that monkeypox may be handled using BSL-2 precautions if personnel are immunized. This notice of policy compiles and clarifies the key information.

Recent reports of laboratory-acquired infections provide convincing evidence for the importance of vaccination to protect against potential occupational exposures to select vaccinia virus strains. The Institutional Biosafety Committee (IBC) has routinely followed the vaccination recommendations of the Centers for Disease Control and Prevention (CDC) for work involving certain vaccinia virus strains (MMWR 2001). This same publication, however, warns against risks associated with this immunization, which can affect not only the worker but also their close contacts. The IBC recommends immunizations based on a risk assessment, but cannot require personnel to receive them. The IBC, however, may require implementation of specific practices that serve to protect personnel.

The Occupational Health Program provides assistance to employees in determining the appropriateness of immunization. When deemed appropriate, the vaccine will be provided at no charge by University Health Service. Contact the Occupational Health Officer (263-2177) or the University Health Service Immunization Nurse (262-7991) for more information about confidential medical counseling and immunizations.

#### Statement of Policy Regarding Select Vaccinia Virus Strains, Cowpox and Monkeypox Viruses

Vaccination should be considered as a protective measure for personnel who may be occupationally exposed to select vaccinia virus strains and to certain zoonotic poxviruses for which the immunization is protective, specifically monkeypox and cowpox viruses. Work with these viruses by individuals who are not immunized must be conducted using the following biosafety level 3 (BSL-3) precautions in a BSL-2 facility.

- Conduct all activities that involve these viruses and materials infected with them in a biological safety cabinet or other containment equipment.
- Change animal cages in a HEPA filtered cage change station or biosafety cabinet (BSC).
- Wear disposable gloves and change them frequently.
- Always wear goggles or face shield when working with virus outside of primary containment devices.
- Protective laboratory clothing such as solid-front or wrap-around gowns, scrub suits, or coveralls are worn by workers in the laboratory. Reusable clothing is decontaminated (autoclaved) before being sent out for laundering.
- Materials must be surface disinfected before leaving the room, such as when waste is transported to the autoclave. Use a chemical disinfectant with known efficacy against poxviruses. Note that poxviruses may be stable when dried onto surfaces.

The adoption of these BSL-3 practices assumes that the following BSL-2 practices are scrupulously followed:

- The Principal Investigator must ensure that training is provided to personnel on the signs and symptoms of disease caused by poxviruses. Personnel must be informed of the increased risk to immunosuppressed individuals. This training should be documented.
- Employ proper hand hygiene. Wash hands thoroughly with soap and water after removing gloves and before leaving the laboratory.
- Protective clothing is removed before personnel leave the lab.
- Use centrifugation safety cups or sealed rotors, and these should be unloaded within a BSC.
- If procedures that generate fine-particle aerosols (such as tissue homogenization in unsealed containers, flow-in-jet cell sorting, and administering virus to animals via injection, etc.) cannot be done in containment, personnel must be fitted with suitable respiratory protection.
- Post biohazard signs in laboratory and animal housing areas.
- Autoclave bedding from infected animals prior to disposal.
- Report all suspected laboratory-acquired infections to the Occupational Health Officer.

Resources that provide additional information on standard precautions for BSL-2 and BSL-3 are available at the biosafety website, <http://www.fpm.wisc.edu/biosafety>. Particularly relevant sources are specific precautions described in Sections III and IV of BMBL and Appendix G of the NIH Guidelines. Contact the Office of Biological Safety for additional guidance on appropriate precautions.

#### Additional Information:

The BMBL agent summary statement for poxviruses recommends “Biosafety Level 2 practices and facilities for all activities involving the use or manipulation of poxviruses, other than variola [smallpox], that pose an infection hazard to humans. All persons working in or entering laboratory or animal care areas where activities with vaccinia, monkey pox, or cow pox viruses are being conducted should have documented evidence of satisfactory vaccination within the preceding ten years. Activities with vaccinia, cowpox or monkeypox viruses, in quantities or concentrations greater than those present in diagnostic cultures, may also be conducted at Biosafety Level 2 by immunized personnel, provided that all manipulations of viable materials are conducted in Class I or II biological safety cabinets. Immunosuppressed individuals are at greater risk of severe disease if infected with poxvirus.”

The CDC provided additional guidance about precautions for handling monkeypox virus and suspect clinical specimens during the recent outbreak of monkeypox. CDC recommended vaccination for personnel working with monkeypox virus and further suggested that work may be conducted under BSL-2 containment by vaccinated personnel, whereas those who are not vaccinated should conduct work using BSL-3 procedures.

Mounting evidence suggests that the efficacy of immunization wanes and revaccination can boost immunity. CDC recommends vaccination within the preceding 10 years for personnel handling the WR strain of vaccinia. CDC allows handling of clinical specimens suspected of harboring monkeypox virus under BSL-2 containment if personnel have been vaccinated within the past 3 years. Personnel who are involved in testing suspect smallpox samples for bioterrorism surveillance are required to be vaccinated but the frequency of re-immunization has not been specified.

Human cases of infection by orf virus, a zoonotic parapoxvirus associated with small ruminants, were recently reported (MMWR 2006, 55:65-68). These infections were correlated with handling animals that had recently been vaccinated with live orf vaccine. While infection with orf virus is more likely to occur in farm hands than laboratory workers, this report provides another example of inadvertent infection caused by inappropriate precautions in handling animals that had received the orf vaccine, a non-attenuated live poxvirus preparation. The report emphasizes the importance of barrier protection (e.g., nonporous gloves) and hand washing, especially for any person with a compromised immune system or a chronic skin disorder (e.g., eczema).

Summary of poxviruses that infect humans and available protective immunization:

Human poxviruses:

Vaccinia virus – Strains and their derivatives vary in virulence. Attenuated vaccinia strains have been used as vaccines against other vaccinia virus strains, variola virus and monkeypox virus. Vaccination is recommended for some strains, such as WR, in the absence of contraindications (e.g., eczema, pregnancy, immunodeficiency, etc).

- ALVAC – highly attenuated strain derived from canarypox virus.
- Canarypox – a fatal disease of canaries that also infects sparrow; not a human pathogen.
- Copenhagen – highly pathogenic for animals; vaccination is recommended.
- Dryvax – the currently licensed vaccinia vaccine in the U.S., containing live attenuated NYCBOH.
- Fowlpox – not a human pathogen.
- Lister – A non-attenuated strain for which vaccination is recommended.
- MVA (modified vaccinia Ankara) – highly attenuated strain derived from the Ankara strain; vaccination is not recommended for this strain.
- NYCBOH – (New York City Board of Health) nonhighly attenuated strain for which vaccination is recommended.
- NYVAC – Highly attenuated strain derived from Copenhagen strain; vaccination is not recommended for this strain.
- Temple of Heaven – highly pathogenic for animals; vaccination is recommended.
- TROVAC – highly attenuated strain derived from fowlpox virus.
- WR (western reserve) – a mouse neuroadapted strain; vaccination is recommended.

Molluscipox virus – causes molluscum contagiosum, a self-limiting infection of epithelial cells (warty papules of the skin with a central umbilication).

Variola virus – the agent of smallpox, an infection of reticuloendothelial, vascular endothelial and epithelial cells. This virus was declared eradicated, and work with this virus is highly restricted.

Zoonotic poxviruses:

Cowpox virus - the agent of cowpox, a self-limiting disease resulting in ulcerative vesicles and pustules on the hands of dairy workers. Protection is provided by vaccinia vaccination.

Monkeypox virus - the agent of monkeypox, a disease similar to smallpox with the additional symptoms of cervical and inguinal lymphadenopathy, but usually slightly less severe. Protection is provided by vaccinia vaccination.

Orf virus - the agent of contagious pustular dermatitis, an epithelial cell infection associated with handling sheep and goats afflicted with “scabby mouth.”

Pseudocowpox virus - the agent of pseudocowpox (Milker's nodules, paravaccinia). This is an epithelial cell infection similar to cowpox, but the lesions are non-ulcerating.

Yaba monkey tumor virus - this causes histiocytomas, typically on the head or limbs.  
Tanapox virus - causes tanapox, a self-limiting epithelial cell infection.

References:

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This policy was adopted by the IBC on

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It will be updated as relevant information becomes available.