VACCINIA VIRUS RESEARCH SAFETY POLICY

POLICY SCOPE

This policy is for the health and safety of individuals working with vaccinia viruses, including recombinant and wild type strains, at the University of Washington (UW). The Occupational Health requirements of this policy apply to non-highly attenuated virus. Examples of non-highly attenuated and highly attenuated strains are shown in Tables 1 and 2 below. This policy provides background information about vaccinia virus in Appendix I, including who is affected, requirements for research approval, medical counseling, and vaccination.

The practices and procedures outlined in this document are in accordance with those described in the CDC Biosafety in Microbiological and Biomedical Laboratories (BMBL), the NIH Guidelines for Recombinant and Synthetic Nucleic Acid Molecules, and University Policy Statement 12.3 with input from Environmental Health and Safety (EH&S) Research and Occupational Safety (ROS), EH&S Campus Preventive Health, UW Employee Health Center at Hall Health (EHC), the Institutional Biosafety Committee (IBC), Office of Risk Management, and Human Resources.

This policy is predicated on shared responsibility among principal investigators (PIs), research staff, research support staff, department chairs and directors, EH&S, and the IBC. This policy is the minimum requirement at the University; there may be specific departmental policies or requirements in addition to this policy.

Table 1. Non-Highly Attenuated Vaccinia Strains

Strain	Biosafety Level (BSL)
Copenhagen	2
Dryvax	2
JYNNEOS	2
Lister	2
NYCBH (New York City Board of Health)	2
Temple of Heaven	2
WR (Western Reserve)	2

Table 2. Highly Attenuated Vaccinia Strains*

Strain	Biosafety Level (BSL)
ALVAC	1
MVA	1
NYVAC	1
TROVAC	1

*Biosafety level 1 (BSL-1) can only be approved if highly attenuated strains are used in the absence of other human orthopoxviruses. The IBC will consider BSL-1 containment on a case-by-case basis.

Please note that these tables do not include all strains of vaccinia virus. If you are unsure what biosafety level is required for a particular strain, contact EH&S at ehsbio@uw.edu.

POLICY SUMMARY

IBC review and approval is required for all research involving vaccinia virus (both highly attenuated and non-highly attenuated). PIs or lab/facility managers must provide and document vaccinia-

specific hazard training. They must also ensure personnel receive medical counseling and follow safety protocols and any workplace restrictions outlined by the EHC.

Personnel who are working directly with non-highly attenuated vaccinia virus are required to receive medical counseling and screening from the EHC prior to initiation of work with vaccinia virus. Personnel must fill out the *Vaccinia Vaccination Consent or Declination* form and either accept or decline the vaccine following medical counseling. Hazard awareness training for these individuals is provided by the PI or lab/facility manager.

Personnel who are not working directly with non-highly attenuated vaccinia virus but who may be exposed to the virus may choose to receive medical counseling and screening from the EHC prior to initiation of work in areas where vaccinia virus may be present. Personnel will then fill out the *Vaccinia Vaccination Consent or Declination* form and either accept or decline the vaccine following medical counseling. Hazard awareness training for these individuals is provided by the PI or lab/facility manager.

Personnel with minimal likelihood of exposure to vaccinia virus or who work only with highly attenuated vaccinia virus in the absence of other human orthopoxviruses are not required to receive medical counseling and screening but are encouraged to contact the EHC if they have health or medical questions.

Table 3. Vaccinia Virus Occupational Health Requirements

Potential for exposure	Work activities	Medical counseling	Vaccination
Direct contact	• Work directly with vaccinia viral cultures, infected material, or any items that have come into contact with vaccinia virus. • Animal husbandry and care of infected animals, including handling bedding of infected animals. • Work in rooms or facilities where animals and procedures are not in primary containment devices (e.g., non-human primate rooms).	Required prior to work	Required to be offered
Indirect contact	• Do not directly handle vaccinia virus cultures, infected materials or animals, or any items contaminated with the virus as described below. • Are present in the same laboratory or animal room where work with vaccinia occurs. Animals and work are in containment devices (e.g., ABSL-2 rodent rooms).	Available (voluntary)	Not generally recommended
Minimal likelihood of exposure	• May enter the workspace where vaccinia work occurs after agents secured and space decontaminated. • Work with highly attenuated vaccinia virus in the absence of other human orthopoxviruses. • Includes custodians, facilities services, and other non-research personnel.	Available (voluntary)	Not recommended

WHO IS AFFECTED

This policy is for UW personnel whose work involves direct or indirect contact with vaccinia virus and for personnel with peripheral responsibilities that support facilities or research spaces where work with vaccinia virus occurs. Personnel are categorized by potential for exposure to vaccinia virus based on work activities. This policy is also for PIs with research involving vaccinia virus and for facility/lab managers with personnel who may have contact with vaccinia virus.

Personnel with direct contact include those who work directly with vaccinia virus, including inoculating and propagating virus in cell culture; harvesting, sonicating, or centrifuging virus; inoculating animals; handling infected animals; or handling any other potentially infected material. Direct contact includes animal husbandry and care of infected animals. It also includes working in animal rooms where primary containment devices are not used (e.g., non-human primate rooms). Personnel with direct contact are required to receive medical counseling and screening from the EHC prior to initiating work with vaccinia virus. Recommendations for vaccination will be made after medical counseling and screening.

Personnel with indirect contact include those who do not directly inoculate with or propagate vaccinia virus either in culture or in animals or contact infected animals or materials contaminated with vaccinia virus but who may work in the same laboratory or animal room where work with vaccinia virus occurs. This may include laboratory research staff, students, and support staff. Personnel with indirect contact are required to receive hazard and safety information in this policy. Medical counseling and screening are available from the EHC but not required.

Personnel with minimal likelihood of exposure include those who work only with highly attenuated vaccinia virus in the absence of other human orthopoxviruses or those who may have to enter the workspace where work with vaccinia virus occurs but are not anticipated to have exposure to potentially infectious materials. This may include custodians, facilities services, and other non-research personnel that support research spaces. These personnel may enter the room only after vaccinia virus-containing cultures or materials have been secured and the space has been decontaminated. Medical counseling and screening is not required; however, if personnel in this category have health or medical questions, they are encouraged to contact the EHC.

Vaccinia virus is extraordinarily environmentally stable but susceptible to decontamination with oxidizers (bleach) and alcohols. Thus, lab surfaces and animal cages that have contact with vaccinia virus or vaccinia-infected animals with open skin lesions should be considered potentially infectious until thoroughly decontaminated. For immunocompetent animals infected with vaccinia virus by dermal scarification (e.g., non-human primates), once all visible lesions have healed, the animals, their bedding, and their excreta are no longer considered potentially infectious. Thus, handling, care, and necropsy of previously infected non-human primates is generally considered indirect contact as long as all skin lesions are long-healed and the bedding and cages have been cleaned in the interim. In contrast, some immunocompetent rodents harbor long-term persistent infection of vaccinia virus in the ovaries. Therefore, dissection of rodents with a history of vaccinia infection, even by routes that never led to skin lesions such as intramuscular or intravenous, is considered direct contact.

OCCUPATIONAL HEALTH REQUIREMENTS

Medical Counseling and Vaccination:
All laboratory, husbandry, and associated personnel who work in a lab with vaccinia virus and have direct exposure to the virus are required to receive **confidential medical counseling** through EHC before beginning work with the virus. Those with indirect contact may also contact EHC to receive medical counseling but it is not required.

- Individuals will be counseled on the risks of working with the virus, consequences of exposure, and the risks and benefits of the vaccine. Individuals will also be medically screened for contraindications to vaccinia exposure or vaccination.
- After medical counseling, the vaccine will be offered to individuals who EHC has determined meet acceptable criteria to receive the vaccine. These individuals will review and sign a *Vaccinia Vaccination Consent or Declination* form. Whether they receive the vaccine or not, all personnel with direct or indirect contact with vaccinia virus must complete the form. EHC will keep this record.
- Personnel have the option to decline the vaccine unless it is a condition of employment specified in the job description. If personnel opt to decline, personnel will sign a declination (form) attesting that they are aware of the risks of working with the virus and have made an informed, personal decision.

Clearance for Work:
Based on the risk assessment and medical review, some staff may be excluded from working with vaccinia.

- A *Vaccinia Clearance* form will be completed by EHC for each employee and returned to the PI indicating whether an individual is cleared to work with vaccinia virus. Any restrictions will also be communicated to the PI with this form. The PI must receive this form prior to assigning any duties that may involve exposure to vaccinia virus. The PI is responsible for following recommendations on the form when assigning duties to research staff. (More on PI responsibilities below.)
- Research staff who experience a change in medical condition may, at the request of the employee, return to EHC for follow-up confidential medical counseling. If a change in clearance to work with vaccinia virus is needed, an updated *Vaccinia Clearance* form will be completed and sent to the PI. (More on employee responsibilities below.)

ROLES AND RESPONSIBILITIES

Principal Investigators (PIs) or Lab/Facility Manager Responsibilities:

- Receive IBC and EH&S approval before beginning research with vaccinia virus. PIs should submit a Biological Use Authorization (BUA) Application with a list of personnel with potential exposure to vaccinia virus to initiate the approval process.
- Notify EH&S of current and new employees who may need the vaccine and arrange with the EHC for personnel to receive medical counseling at least 6-8 weeks prior to starting work with vaccinia virus.

- Assign duties that involve potential exposure to vaccinia virus only after personnel have completed medical screening/counseling and clearance.
- Ensure that workplace medical restrictions for personnel are adhered to.
- In some cases, the PI may not be willing or able to modify the duties of the employee. The PI will consult with Human Resources prior to employee's work assignments.
- Provide and document annual lab-specific training for research staff. In addition to EH&S biosafety training, the PI will be responsible to ensure that staff are trained annually to work safely with vaccinia virus. Records of this training shall be kept and reviewed by the BSO during regular lab inspections. (Use *Appendix IV* below.)
- Ensure staff read and follow this policy.
- Ensure staff follow BSL-2 lab practices including use of personal protective equipment (PPE) to include eye and mucous membrane protection and implement a lab-specific vaccinia virus standard operating procedure (SOP) for any procedures outside of standard BSL-2 lab practices.
- Follow the vaccinia virus SOP for first aid and reporting of possible exposure to the agent or biohazardous materials. Report any lab accidents to EHC immediately and fill out an on-line accident report.
- Restrict access to required personnel when work with vaccinia virus is in process.
- Ensure proper decontamination procedures are followed.
- Ensure activities with vaccinia virus are suspended and laboratory spaces are properly decontaminated before non-lab personnel enter.

Research personnel responsibilities:

- Complete the *Vaccinia Vaccination Consent or Declination* form after medical consultation with EHC.
- Adhere to any other restrictions imposed by the EHC, PI, IBC, or EH&S for work with vaccinia virus.
- Follow this policy, BSL-2 lab practices (including appropriate PPE), and lab-specific vaccinia virus SOP (if required).
- Decontaminate laboratory spaces and equipment appropriately after work with virus.
- Report any exposure, potential exposure, or spill to the PI or lab supervisor and EH&S immediately after completing first aid (refer to *Appendix II*).
- If personal health conditions or job duties change during the year, personnel must contact EHC.

EH&S responsibilities:

- Provide medical counseling, screening, vaccine administration, and maintenance of confidential employee health records. (EHC)
- Complete *Vaccinia Clearance* form and return to the PI/supervisor. (EHC)

- Provide hazard communication to PI in Occupational Health Recommendations (OHR). (ROS)
- Review research involving work with vaccinia virus and determine if lab-specific vaccinia virus SOP is needed; provide recommendations to the IBC if additional practices and controls are necessary. (ROS)
- Inspect labs regularly to verify that researchers follow appropriate practices and procedures and have received appropriate training. (ROS)
- Report lab accidents to NIH, OSHA, and other agencies as appropriate. (ROS)

IBC responsibilities:

- Review and vote to approve all research proposals with vaccinia virus.
- Review and approve any additional work practice controls and SOPs if necessary.

APPENDIX I: VACCINIA VIRUS HAZARD INFORMATION

What is vaccinia virus?
Vaccinia virus belongs to the *Poxviridae* family and is well-known for its role as a vaccine used for the eradication of smallpox caused by a related virus, variola virus. Inadvertent exposure to vaccinia virus can result in infection, and severe complications can occur in persons with underlying risk factors (e.g., pregnancy, immunodeficiency, or certain dermatologic conditions). Scientists study vaccinia virus to understand the biology of poxviruses, to understand immune responses to viruses, and as a tool for delivering genes into biological tissues and cells.

Is disease caused by VACV seen in the United States?
The only sources of vaccinia virus exposure are in the laboratory or through vaccination programs. Vaccinia virus has no natural human or animal reservoir.

In 2004 a *CDC Emerging Infectious Diseases* dispatch article described an ocular infection in a laboratory worker in Philadelphia. See the following web link, page 2, for review of practices that provided opportunity for infection - http://wwwnc.cdc.gov/eid/article/12/1/pdfs/05-1126.pdf.

During 2005-2007, five cases of laboratory acquired vaccinia virus infection were reported to CDC. No known contact transmission of vaccinia virus was reported from these laboratory-acquired infections; however, instances of contact transmission of vaccinia virus from vaccinees to close contacts, including children and partners, has occurred. In 2008, CDC was notified of a suspected case of inadvertent autoinoculation and vaccinia virus infection in an unvaccinated laboratory worker.

In 2010, the Centers for Disease Control and Prevention (CDC) reported that a woman in Washington had contracted vaccinia virus infection after physical contact with a military member who was recently vaccinated for smallpox. The CDC indicated that it was aware of four similar cases in the preceding 12 months after contact with a recently vaccinated military member.

How is vaccinia virus spread?
Accidental exposure to vaccinia virus may occur through ingestion, parenteral inoculation, and droplet or aerosol exposure of mucous membranes or broken skin with infectious particles. Ocular exposure is of particular concern. Protective eyewear or other shielding must be used when working with vaccinia virus outside of a biological safety cabinet.

Different strains of vaccinia virus used in research and clinical settings present different levels of risk. Recommendations for vaccinia vaccination differ depending upon the strains of vaccinia virus and the setting in which they will be used. The following medical conditions may increase risk of infection or risk of complications following exposure to vaccinia virus:

- Diagnosis and/or history of eczema; even if condition is mild and not presently active.
- Household contacts with diagnosis and/or history of eczema.
- Other acute or chronic skin conditions including atopic dermatitis, burns, impetigo, etc.
- Any diseases or conditions that cause immunodeficiency including leukemia, lymphoma, other malignancies, HIV infection, therapy with alkylating agents, antimetabolites, radiation, high dose steroids.
- Household contacts with immunodeficiency disease or therapy listed above.

- Pregnancy or planning to become pregnant within 1 month following vaccination or accidental exposure.

What are the symptoms?
A vaccinia virus infection is very mild and typically asymptomatic in healthy individuals, but it may cause a mild rash and fever. Symptoms seen rarely and usually in immunocompromised individuals may include a severe rash that can leave scars when healed, a high fever, tiredness, severe headaches and backache, blindness, or even death.

What is the treatment for exposure?
Treatment for vaccinia virus infection includes antivirals and pain medication. Treatment for vaccinia virus infection depending on severity may include antivirals, vaccinia immune globulin, and/or local care of lesions and symptomatic treatment.

How soon do symptoms appear?
On average, symptoms occur 6 to 15 days after exposure.

Is there a vaccine?
Vaccinia virus is still being used as a vaccine against smallpox. Unlike vaccines that use weakened forms of the virus being vaccinated against (e.g., measles), vaccinia virus cannot cause smallpox because it does not contain variola virus, the causative agent of smallpox. The immune response generated against vaccinia virus protects the person against lethal smallpox. Complications and/or vaccine adverse effects occasionally arise primarily in people who are immunocompromised.

If I am only using the vaccine strain, why should I be vaccinated?
During 2005-2007, five cases of laboratory acquired vaccinia virus infection were reported to CDC. Although no national surveillance system exists to track laboratory related vaccinia virus exposures, the five cases were reported to CDC informally while seeking consultation on treatment and prevention. All five cases involved the Western Reserve strain. Cases 1 - 4 involved recombinant vaccinia viruses with an insertion at the thymidine kinase (TK) locus. Case 5 also involved a recombinant vaccinia virus, but details of the virus are not known.

I was vaccinated for smallpox as a child, do I need to be vaccinated again?
The Advisory Committee on Immunization Practices (ACIP) recommends smallpox vaccination at least every 10 years for personnel who handle non-highly attenuated vaccinia virus strains or other orthopoxviruses (e.g., monkey pox, cowpox, or variola).

APPENDIX II: WHAT TO DO IF EXPOSED TO VACCINIA VIRUS AT WORK

The Exposure Response Poster provides instructions for exposure response and should be posted in all laboratory areas. For an exposure incident, follow these steps immediately:

1. **Perform First Aid**
   a. Needlestick, puncture or sharps injury, or animal bite/scratch
      - Wash thoroughly for 15 minutes with warm water and sudsing soap.
   b. Eye exposure
      - Use emergency station to flush eyes for 15 minutes while holding eyes open.
   c. Skin exposure
      - Wash with sudsing soap and water for 15 minutes.
   d. Inhalation or ingestion
      - Move out of the contaminated area and seek fresh air.
      - Do not induce vomiting unless instructed to do so.
   e. Splash Affecting Garments
      - Remove garments that may have become soiled or contaminated and place them in a double red plastic bag.

2. **Get Medical Help**
   Be ready to share details of exposure (agent, dose, route, time of exposure, MSDS/SDS).
   a. Call 911 for any life-threatening emergency.
   b. For all other injuries and exposures:
      - During Business hours (Monday thru Friday 8 a.m. to 5 p.m.):
        Call the UW Employee Health Center at **206-685-1026**.
      - Harborview sites call **206-744-3081**.
      - Outside of Business hours or if Employee Health Center is closed:
        Call 911 and follow the instructions given.
   c. In all cases, notify your supervisor as soon as possible. Secure the area before leaving.

3. **Report Within 24 Hours via OARS (Online Accident Reporting System):**
   https://oars.ehs.washington.edu/.
   a. For hospitalization, fatality, or recombinant nucleic acid exposure:
      - Notify EH&S immediately at **206-543-7262**.
      - Outside of business hours:
        Call **206-685-UWPD (8973)** to reach EH&S staff on call.

APPENDIX III: CONTACTS

1. University of Washington Employee Health Center (EHC): 206-685-1026
2. Harborview Medical Center Employee Health: 206-744-3081
3. EH&S Biological Safety: 206-221-7770 or ehsbio@uw.edu
4. EH&S General Line: 206 543-7262 or ehsdept@uw.edu
5. UW Police Department: 206-685-UWPD (8973)

APPENDIX IV: REFERENCES

- CDC Biosafety in Microbiological and Biomedical Laboratories (BMBL) 6th Edition
- Centers for Disease Control Smallpox Vaccine Basics website
- Laboratory-Acquired Vaccinia Exposures and Infections --- United States, 2005—2007. MMWR 57 (15); April 18, 2008; pp 401-404.
- Ocular Vaccinia Infection in Laboratory Worker, Philadelphia, 2004; Emerging Infectious Diseases, vol.12, No.1, Jan.2006; www.cdc.gov/eid.
- UW Biosafety Manual
- Vaccinia (Smallpox) Vaccination Recommendations of the Advisory Committee on Immunization Practice. MMWR 50 (RR 10); June 22, 2001; pp 1-25.
- Vaccinia Virus Infection After Sexual Contact with a Military Smallpox Vaccine --- Washington, 2010. MMWR Vol. 59 / No. 25; July 2, 2010; pp 773-775.
- Vaccinia Virus Canadian Pathogen Safety Data Sheet

APPENDIX IV: DOCUMENTATION OF TRAINING AND OFFERING OF VACCINIA VACCINE (to be retained by Principal Investigator)

Training is required for personnel who have both direct and indirect contact.

By signing below, I indicate that I have read and understand the UW Vaccinia Policy. I have been given a chance to ask questions. I will adhere to the policy, hazards, medical requirements, safe work practices, and accident reporting outlined in the policy.

Employee Name	Hazard Awareness Training Date	Date Vaccine Offered	Employee Signature	PI Signature