### Agent Characteristics

<table>
<thead>
<tr>
<th>Risk Group (RG)</th>
<th>Agent: Lentiviral Vectors – 3rd and Higher Generations</th>
</tr>
</thead>
<tbody>
<tr>
<td>RG-2</td>
<td>associated with serious or lethal human disease; preventive or therapeutic interventions may be available</td>
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</tbody>
</table>

### Description

Lentiviruses are medium-sized (120 nm), enveloped viruses composed of a nucleocapsid containing two copies of single-stranded positive-sense RNA. Lentivirus is a genus of slow viruses (lente-, Latin for "slow") of the Retroviridae family, characterized by a long incubation period. The viruses are species-specific in host range and several have been recognized as pathogens of domestic animals, non-human primates and humans.

In a third-generation system, only gag, pol, and rev genes remain present (tat is eliminated). The rev gene is provided in a separated plasmid. Since the HIV promoter in 5' LTR depends on tat, a vector that lacks tat needs to have its wild type promoter replaced with a heterologous enhancer/promoter such as CMV or RSV to ensure transcription.

Third generation systems (or higher) are currently the safest to use because the virus production is split across four (or more) plasmids.

The host range is dependent upon the viral envelope glycoproteins and structural proteins involved in integration. Possible hosts include human, murine, feline, bovine, and avian. The Viscericular Stomatitis Virus glycoprotein G (VSV-G), which allows gene transfer to a broad array of cell types and species, is frequently used for pseudotyping of lentiviral vectors. Though advantageous for research purposes, this poses an increased risk of infection in case of exposure to VSV-G-pseudotyped lentiviral vectors for lab workers, since these vectors will be able to target a larger range of cells.

### Health Hazards

**Signs and Symptoms**
- Flu-like symptoms (i.e. fever, headache, dehydration, weight loss, lethargy)
- Cutaneous symptoms (i.e. skin lesions, rash)
- Gastrointestinal symptoms (i.e. loss of appetite, nausea, vomiting, diarrhea)
- Neurological symptoms (i.e. loss of sensation, ataxia)
- Musculoskeletal symptoms (i.e. joint and muscle pain)
- Lymphoreticular symptoms (i.e. enlarged internal organs or lymph nodes)
- Other:

**Immunizations:** Not Available

**Prophylaxis:** Post exposure prophylaxis for occupational exposure with HIV-based viral vectors may include the use of anti-retroviral drugs.

### Laboratory Hazards

- Handling of sharps (needles, scalpels, microtome blades, broken glass, etc.)
- Splash/droplet-creating activities (shaking incubators, liquid culturing, mechanical pipetting)
- Exposed skin/uncovered wounds

### Laboratory Handling Guidelines

- **Laboratory Biosafety Level (BSL):**
  - BSL-2

- **Note:** 3rd generation and higher lentiviral vectors are usually pseudotyped with a human tropic envelope, such as the VSV-G envelope. In this case, BSL2 containment is implemented since these viruses now have the capability of transducing human cells.

- **Attenuated Strain Alternatives:** n/a
- **Training:**
  - EHS Laboratory Safety Training (CULearn#2555)
  - EHS Bloodborne Pathogens Training (CULearn#1070)
  - Lab-specific protocol training
  - BARS CULearn#2277.47
- **Lab Engineering Controls**
  - Biosafety Cabinet (for aerosol containment)
  - Centrifuge lids or safety cups; samples are loaded/unloaded inside the BSC
  - Use of safety-engineered sharps
- **Personal Protective Equipment (PPE):**
  - Eye protection - For activities conducted outside of a biosafety cabinet (e.g. stereotactic injection), the use of nucous membrane protection devices is of extreme importance.
  - Single gloves
  - Snap-front lab coat with cinch cuffs
- **Waste Management:** Regulated Medical Waste (RMW)
- **Shipping Guidance:** Refer to EHS Biological Materials Shipping

### Animal Vivarium Guidance

- **Animal Housing Biosafety Level (ABSL):**
  - ABL-1
  - ABL-2

- **Note:** Animals receiving retroviral vectors will remain at ABL-2 for 7 days, then can be moved to ABL-1 after cage change. This may not apply if the animals contain any human cells or tissues

- **Experimental animals are housed separately**

### Agent Viability

- **Agent: Lentivirus**
  - BARS Lentivirus 3++
  - Effective 8/1/2017

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**Controlled document if viewed online. Uncontrolled if viewed in print.**

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**EHS/Biosafety Page 1**
Biosafety Level 2 Containment Requirements Summary

<table>
<thead>
<tr>
<th>Exposure and Spill Procedures</th>
<th>Medical Follow Up</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mucous Membranes</strong></td>
<td><strong>During Business Hours</strong></td>
</tr>
<tr>
<td>Wash eyes, mouth or nose for 15 minutes at eyewash station. See: responding to exposures.</td>
<td>Cornell Health 607-255-5155 (24-hour phone consultation line)</td>
</tr>
<tr>
<td><strong>Other Exposures</strong></td>
<td><strong>After Hours Care:</strong></td>
</tr>
<tr>
<td>Wash with soap and water for 15 minutes (open wounds, sores, etc.) and a minimum of 20 seconds of soap and water for areas with intact skin. See: responding to exposures.</td>
<td>Cornell Health Services 24-hour phone consultation line or local urgent care as listed on above webpage.</td>
</tr>
<tr>
<td><strong>Small Spills</strong></td>
<td><strong>Emergencies:</strong></td>
</tr>
<tr>
<td>Notify others working in the lab. Evacuate area and allow 30 minutes for aerosols to settle. Don appropriate PPE. Cover area of the spill with paper towels and apply disinfectant, working from the perimeter toward the center. Allow 30 minutes of contact time before disposal and cleanup of spill materials. See: spill cleanup.</td>
<td>Call 911 from a campus phone or 607-255-1111 from a mobile phone.</td>
</tr>
<tr>
<td><strong>Large Spills</strong></td>
<td></td>
</tr>
<tr>
<td>Request assistance from the EHS Spill Team by calling CUPD dispatch. Call 911 from a campus phone or 607-255-1111 from a mobile phone.</td>
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</tbody>
</table>

**Incident Reporting**

Immediately report the incident to supervisor and complete the EHS online injury/illness report as soon as possible.

**Regular Medical Waste (RMW)**

Soft waste:
- All materials that come into contact with this agent are placed in a biohazard waste bag.
- If working in a BSC, have a biohazard waste bag inside the BSC for waste collection.
- All equipment, tubing, and waste bags that are brought out of the biosafety cabinet are wiped with appropriate disinfectant.
- Place smaller red bag waste from BSC into larger red bag outside the BSC for transport.

Sharps waste:
- Place in leak proof sharps container labeled with the biohazard symbol. If working in a BSC, place a sharps container in the BSC.

Liquid waste:
- Add EHS-approved disinfectant to appropriate concentration, hold for contact time specified per manufacturer’s guidelines, and then gently pour down the drain.

**Regulated Medical Waste (RMW) Online RMW Pickup Request**

Soft waste:

Sharps waste:

Liquid waste:

**Special Considerations**

See lab protocols for additional information, any deviations from this BARS, and for lab-specific expectations.

**References**


**Cornell EHS would like to thank Emory University for the use of their Biological Agent Reference Sheet (BARS) format and some content.**