*The NIH has determined that rDNA from infectious agents of BL-2 or above is not exempt and must receive Biosafety approval. Additionally, certain **cloning vectors**, such as Adeno or Sindbis based vectors, or amphotrophic MMLV based vectors, are some examples of rDNA that are non-exempt.

If your experiment does not fall within the exempt categories, you **MUST** obtain APB approval.

Viral Vectors and Transgenes

All vectors are not the same. More importantly, the class of gene insert can change the Biosafety level of the construct. It is also important to realize that obtaining a cloning/ expression vector from a commercial source does not mean it is automatically exempt or a BSL-1. Table 1 lists many of the more common viral vectors in combination with different classes of inserts and their associated BSL level.

Table 1.

Gene transfer vector[a]	Host range[b]	Insert or gene function[c]	Laboratory containment level[d]
MMLV based- *gag, pol, env* deleted	Ecotropic	S, E, M, G, CC, T, MP, DR, R, TX O_v, O_c	BSL-1*
	Amphotropic, VSV-G pseudotyped	S, E, M, T, MP, DR	BSL-2
		O_v, O_c, R, G, CC	BSL-2+/BSL-3
		TX	BSL-3
Herpes virus based- nonlytic	Broad host range	S, E, M, MP, DR, T	BSL-2
		O_v, O_c, R, G, CC	BSL-2+
		TX	BSL-3
Lentivirus based- HIV, SIV, EIAV, FIV, etc.; *gag, pol, env, nef, vpr* deleted	Ecotropic, amphotropic, VSV-G pseudotyped	S, E, M, MP, DR,	BSL-2+/BSL-3, until
		O_v, O_c, R, G, CC, T	safety issues then BLS-2/ BSL-2+ may be appropriate
		TX	BSL-3
Adenovirus based- Serotype 2, 5, 7; E1 and E3 or E4 deleted	Broad host range, infective for many cell types	S, E, M, T, MP, DR	BSL-2
		O_v, O_c, R, G, CC	BSL-2+
		TX	BSL-3
Alphavirus based- SFV, SIN	Broad host range	S, E, M, T, MP, DR	BSL-2
		O_v, O_c, R, G, CC	BSL-2+
		TX	BSL-3
Baculovirus based	Broad mammalian host cell range	S, E, M, T, MP, DR	BSL-1*
		O_v, O_c, R, G, CC	BSL-2
		TX	BSL-2+/BSL-3
Parvovirus, AAV based- (rep^-, cap^-)	Broad host range, infective for many cell types including neurons	S, E, M, T, MP, DR	BSL-1*
		O_v, O_c, R, G, CC	BSL-2
		TX	BSL-2+/BSL-3
Poxvirus based- caarypox, vaccinia	Broad host range	S, E, M, T, DR, MP	BSL-2
		O_v, O_c, R, G, CC, TX	BSL-2+/BSL-3

[a]Refers to the parental or wild-type virus.

Gene transfer vector[a]	Host range[b]	Insert or gene function[c]	Laboratory containment level[d]
MMLV based- *gag, pol, env* deleted	Ecotropic	S, E, M, G, CC, T, MP, DR, R, TX O_v, O_c	BSL-1*
	Amphotropic, VSV-G pseudotyped	S, E, M, T, MP, DR	BSL-2
		O_v, O_c, R, G, CC	BSL-2+/BSL-3
		TX	BSL-3
Herpes virus based- nonlytic	Broad host range	S, E, M, MP, DR, T	BSL-2
		O_v, O_c, R, G, CC	BSL-2+
		TX	BSL-3
Lentivirus based- HIV, SIV, EIAV, FIV, etc.; *gag, pol, env, nef, vpr* deleted	Ecotropic, amphotropic, VSV-G pseudotyped	S, E, M, MP, DR, O_v, O_c, R, G, CC, T	BSL-2+/BSL-3, until safety issues resolved, then BLS-2/ BSL-2+ may be appropriate
		TX	BSL-3
Adenovirus based- Serotype 2, 5, 7; E1 and E3 or E4 deleted	Broad host range, infective for many cell types	S, E, M, T, MP, DR	BSL-2
		O_v, O_c, R, G, CC	BSL-2+
		TX	BSL-3
Alphavirus based- SFV, SIN	Broad host range	S, E, M, T, MP, DR	BSL-2
		O_v, O_c, R, G, CC	BSL-2+
		TX	BSL-3
Baculovirus based	Broad mammalian host cell range	S, E, M, T, MP, DR	BSL-1*
		O_v, O_c, R, G, CC	BSL-2
		TX	BSL-2+/BSL-3
Parvovirus, AAV based- (rep^-, cap^-)	Broad host range, infective for many cell types including neurons	S, E, M, T, MP, DR	BSL-1*
		O_v, O_c, R, G, CC	BSL-2
		TX	BSL-2+/BSL-3
Poxvirus based- caarypox, vaccinia	Broad host range	S, E, M, T, DR, MP	BSL-2
		O_v, O_c, R, G, CC, TX	BSL-2+/BSL-3

[a]Refers to the parental or wild-type virus.

[b]Refers to the ability of vector to infect cells from a range of species. Ecotropic generlly means able to infect only cells of species originally isolated from or identified in. Please note that the ecotropic host for HIV and HSV would be human cells, but the ecotropic host for MMLV would be murine cells. Amphotropic and VSV-G pseudotyped virus host range includes human cells.

[c]General categories of cellular genes and functions: S, structural proteins: actin, myosin, etc.; E, enzymatic proteins: serum proteases, transferases, oxidases, phosphatases, etc.; M, metabolic enzymes: amino acid metabolism, nucleotide synthesis, etc.; G, cell growth, housekeeping; CC, cell cycle, cell division; DR, DNA replication, chromosome segregation, mitosis, meiosis; MP, membrane proteins, ion channels, G-coupled protein receptors, transporters, etc.; T, tracking genes such as GFP, luciferases, photoreactive genes; TX, active subunit genes for toxins such as ricin, botulinum toxin, Shiga, and Shiga-like toxins; R, regulatory genes, transcription, cell activators such as cytokines, lymphokines, tumor suppressors; O_v and O_c, oncogenes identified via transforming potential of viral and cellular analogs, or mutations in tumor suppressor genes, resulting in a protein that inhibits/moderates the normal cellular wild-type protein. This does not include SV40 T antigen. SV40 T antigen-containing cells should not be considered more hazardous than the intact virus. The prevalence of SV40 infection in the U.S. population due to contaminated polio vaccine does not seem to have caused an increased rate of cancers (Strickler et al., 1998). However, a cautionary note might be in order. More recent assessment of epidemiologic data suggests a possible causative role for SV40 in some human cancers (Butel and Lednicky, 1999).

[d]This is a general assessment of appropriate containment for construction and laboratory use of these vectors for nonproduction quantities only based on the 1999 CDC/NIH BMBL. It cannot cover every potential use within a research or laboratory setting; as information is gained an assessment may be changed. Local IBCs should use their best judgment with the available information to determine appropriate containment levels. BSL-1* refers to the containment level based on parent virus risk group. However, most procedures involving the handling and manipulation of the viral vectors are done at BSL-2 to protect cell cultures and viral stocks from contamination.