Committee on Microbiological Safety Policy Manual
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Introduction

I. Purpose

Harvard University’s Committee on Microbiological Safety (COMS) serves as the Institutional Biosafety Committee (IBC) for Harvard as well as the Harvard-affiliated medical and research institutions listed in Appendix A hereto (the “Affiliated Institutions). COMS is responsible for reviewing all research projects involving recombinant DNA (rDNA) as defined by the NIH OBA and biological agents to be conducted at or sponsored by any of these institutions; no such project may be commenced without COMS approval.

II. Function

So that the biological aspects of the research are conducted in a safe manner using established biosafety standards, principles and practices, COMS shall establish, maintain and update policies and procedures on the proper use of rDNA, biological and clinical materials. COMS also shall establish minimum standards and best practices for the oversight and administration of research with rDNA and other hazardous biological materials that may pose safety, health, or environmental risks, including, for example, requirements for education and training and for laboratory safety policies. All COMS materials must comply with applicable biosafety standards and applicable federal, state and local laws and regulations and also shall take into consideration relevant worker safety, public health, agricultural and environmental protection, and ethical standards.

III. Roles and Responsibilities

Harvard University

Harvard is responsible for running COMS and thus has the authority to establish policies and procedures that COMS shall follow in its initial and continuing review and approval of
applications, proposals, and activities. For research conducted at or sponsored by Harvard, Harvard also is responsible for compliance with all training and other safety requirements imposed by COMS or by federal, state or local legislation or regulation. Specifically, Harvard shall:

A) Establish and implement policies for the safe conduct of research involving rDNA or other hazardous biological materials.
B) Establish and maintain COMS in compliance with the NIH Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines).
C) Appoint a Biological Safety Officer (BSO) to serve as a member of COMS.
D) Appoint at least one individual with expertise in plant, plant pathogen, or plant pest containment principles to serve either as a regular member of COMS or as an ad hoc member of COMS. This person must be present any time COMS considers a research proposal governed by the NIH Guidelines Appendix P, Physical and Biological Containment for Recombinant DNA Research Involving Plants. Appoint at least one individual with expertise in animal containment principles to serve as a member of COMS.
E) Choose as members of COMS only people with appropriate expertise. Provide appropriate training for the COMS Chair and all COMS members, including without limitation the Biological Safety Officer and other containment experts.
F) For research conducted at or sponsored by Harvard, provide appropriate training on laboratory safety and implementation of the NIH Guidelines to all Principal Investigators and laboratory staff.
G) For research conducted at or sponsored by Harvard, establish mechanisms for having all research involving rDNA or other hazardous biological materials reviewed by COMS.
H) For research conducted at or sponsored by Harvard, establish mechanisms for compliance with the NIH Guidelines by all Principal Investigators (PIs) including, for example, the requirements that:

1) All aspects of NIH Guidelines Appendix M must be appropriately addressed by any PI who is conducting human gene therapy trials;
2) No research participant may be enrolled in a human gene transfer experiment until the Recombinant DNA Advisory Committee (RAC) review process has been completed, COMS approval has been obtained, Institutional Review Board approval has been obtained, and any other applicable regulatory authorization has been obtained.

I) For research conducted at or sponsored by Harvard, determine the necessity for health surveillance of personnel involved in connection with individual rDNA projects; and if appropriate, establish and maintain a health surveillance program for such projects. Such a program shall be required if personnel are:

   1) Engaged in large-scale research or production activities involving viable organisms containing rDNA molecules that require Biosafety Level Three (BL3) containment.

   2) Engaged in animal research involving viable rDNA-containing microorganisms that require BL3 or greater containment.

J) For research conducted at or sponsored by Harvard, work with COMS to report any significant problems, violations, or any significant research-related accidents or illnesses to applicable governmental agencies, following the COMS Incident Reporting and COMS Clinical Trial Standard Operating Procedures (SOP).

K) For research conducted at or sponsored by Harvard, provide COMS-approved training as outlined in the COMS Training SOP

Affiliated Institutions

The Affiliated Institutions recognize and agree that Harvard has the authority to establish policies and procedures that COMS shall follow in its initial and continuing review and approval of applications, proposals, and activities. For research conducted at or sponsored by an Affiliated Institution, that Affiliated Institution is responsible for making sure that its laboratories and personnel are in compliance with all training and other safety requirements imposed by COMS or by federal, state or local legislation or regulation. Specifically, each Affiliated Institution shall:
A) Establish and implement policies for the safe conduct of research involving rDNA or other hazardous biological materials.

B) Appoint a Biological Safety Officer (BSO) with appropriate expertise to serve as the primary liaison between the Affiliated Institution and COMS. Provide appropriate training for the Biological Safety Officer.

C) For research conducted at or sponsored by the Affiliated Institution, provide appropriate training on laboratory safety and implementation of the NIH Guidelines to all Principal Investigators and laboratory staff.

D) For research conducted at or sponsored by the Affiliated Institution, establish mechanisms for having all research involving rDNA or other hazardous biological materials reviewed by COMS.

E) For research conducted at or sponsored by the Affiliated Institution, establish mechanisms for compliance with the NIH Guidelines by all Principal Investigators (PIs) including, for example, the requirements that:
   1) All aspects of NIH Guidelines Appendix M must be appropriately addressed by any PI who is conducting human gene therapy trials;
   2) No research participant may be enrolled in a human gene transfer experiment until the RAC review process has been completed, COMS approval has been obtained, Institutional Review Board approval has been obtained, and any other applicable regulatory authorization has been obtained.

F) For research conducted at or sponsored by the Affiliated Institution, determine the necessity for health surveillance of personnel involved in connection with individual rDNA projects; and if appropriate, establish and maintain a health surveillance program for such projects. Such a program shall be required if personnel are:
   1) Engaged in large-scale research or production activities involving viable organisms containing rDNA molecules that require BL3 containment.
   2) Engaged in animal research involving viable rDNA-containing microorganisms that require BL3 or greater containment.

G) For research conducted at or sponsored by the Affiliated Institution, follow the COMS Incident Reporting and COMS Clinical Trial Standard Operating Procedures (SOP).
H) For research conducted at or sponsored by the Affiliated Institution, provide training as outlined in the COMS Training SOP

_Committee on Microbiological Safety (COMS)_

As the IBC responsible for the review and approval of all research involving rDNA and other hazardous biological materials to be conducted at or sponsored by Harvard or any of the Affiliated Institutions, COMS shall:

A) Maintain membership of no fewer than five members selected for their collective experience and expertise in rDNA technology and for their ability to assess the safety of rDNA research and identify any potential risk to public health or the environment. COMS membership shall include:

1) At least two members not affiliated with Harvard or any of the Affiliated Institutions (apart from their membership on COMS) and who represent the interest of the surrounding community with respect to health and protection of the environment.

2) At least one individual with expertise in plant, plant pathogen, or plant pest containment principles when experiments utilizing Appendix P, Physical and Biological Containment for Recombinant DNA Research Involving Plants, require prior approval by the COMS.

3) At least one member representing Harvard’s laboratory technical staff

4) The Institutional BSO when an Affiliated Institution conducts rDNA research at BL3, BL4, or Large Scale (greater than 10 liters of biological culture),

5) On a rotating basis, Institutional BSOs from Affiliated Institutions that do not conduct rDNA research at BL3, BL4, or Large Scale (greater than 10 liters of biological culture),

6) Members with expertise and training in rDNA research involving human research participants

7) Members with expertise in rDNA technology, biological safety, and physical containment
8) Ad hoc members knowledgeable in institutional commitments and policies, applicable law, standards of professional conduct and practice, community, and the environment

B) Review rDNA research conducted at or sponsored by Harvard or the Affiliated Institutions in accordance with the requirements set forth in the NIH Guidelines, approving only those research projects that are found to conform with the NIH Guidelines (as outlined in the COMS Protocol Review and COMS Protocol Maintenance SOPs). Such review and approval may involve setting containment levels as specified in NIH Guidelines Sections III-D-4-b, Experiments Involving Whole Animals, and NIH Guidelines Section III-D-5, Experiments Involving Whole Plants.

C) Periodically review rDNA research conducted at or sponsored by Harvard or the Affiliated Institutions listed above to check compliance with the NIH Guidelines.

D) Ensure adequacy of emergency plans and procedures for addressing accidental spills and personnel contamination resulting from or related to rDNA or infectious agent research.

E) Follow the COMS Incident Reporting and COMS Clinical Trial Standard Operating Procedures (SOP).

Harvard Office of Biological Safety

Harvard’s Office of Biological Safety, located at Harvard Medical School, bears administrative responsibility for COMS, and shall:

A) File an annual report with NIH/OBA that includes: (i) a roster of all COMS members clearly indicating the Chair, contact person, BSOs, plant expert (if applicable), animal expert, experts in human gene therapy; and (ii) biographical sketches of all new COMS members.

B) Make available to the public all COMS meeting minutes and any documents submitted to or received from federal funding agencies that these agencies are required to make available to the public.

C) File an annual report with the Boston Public Health Commission (BPHC) which includes: (i) a list of rDNA studies approved by COMS; (ii) a roster of all COMS members, and (iii) minutes of COMS meetings.
D) Notify Principal Investigators of the results of COMS review of their research proposals through each institutional biosafety officer
E) Establish mechanisms for communication between COMS and the relevant Institutional Review Boards (IRB) and Institutional Animal Care and Use Committees (IACUC).
F) Ensure biological safety laboratory inspections in accordance with COMS Laboratory Inspection SOP
G) Ensure reporting of laboratory incidents per COMS Laboratory Incident Reporting SOP and COMS Clinical Trial SOP
H) Maintain a secure electronic database for COMS protocol documentation
I) Appropriately archive COMS records, including:
   1) Records of research projects reviewed by COMS,
   2) COMS minutes,
   3) Other documents related to COMS activities.
J) Monitor national, state and local regulatory trends and communicate any changes to the Biosafety Officers and responsible institutional representatives.
K) Develop rDNA and biological safety training materials

Institutional Biological Safety Officers (BSOs)

Harvard and the Affiliated Institutions each are responsible for their own compliance with all training and other safety requirements imposed by COMS or by federal, state or local legislation or regulation. To this end, the Institutional Biological Safety Officers (BSOs) shall, for their own institutions:

A) Assess the risk of proposed research applications and make recommendations to COMS as to appropriate containment, procedures, and personal protective equipment.
B) Oversee laboratory inspections in accordance with the COMS Laboratory Inspection SOP
C) Immediately report to COMS and their institution any significant problems, violations, or any significant research-related accidents or illnesses as defined in SOP
D) Develop emergency plans and procedures for handling accidental spills and personnel contamination and investigating laboratory accidents resulting from or related to rDNA or infectious agent research
E) Provide advice and guidance on laboratory security
F) Provide technical advice and guidance to PIs and COMS on research safety procedures
G) Monitor:
   1) Institutional Animal Care and Use Committee (IACUC) applications,
   2) Institutional Review Board (IRB) applications
   3) Institutional Material Transfer Agreements (MTAs)
   4) Grants & Contracts Office

**Principal Investigators**

Principal Investigators bear ultimate responsibility for conducting their research in compliance with all training and other safety requirements imposed by COMS or by federal, state or local legislation or regulation.

A) In general, a PI shall:
   1) Obtain COMS approval before initiating or modifying any and all research involving rDNA, infectious agents, biological toxins classified as select agents, or human or non-human primate blood, tissues, or cells
   2) Immediately report any significant problems, violations, or any significant research-related accidents or illnesses to his or her Institutional BSO, and work with COMS to report applicable governmental agencies, following the COMS Incident Reporting and COMS Clinical Trial Standard Operating Procedures (SOP).
   3) Make sure that he or she has received adequate training on good microbiological techniques
   4) Adhere to institutional emergency plans and procedures for handling accidental spills and personnel contamination resulting from or related to rDNA or infectious agent research.
   5) Comply with all applicable shipping requirements for infectious agents and rDNA
B) Before initiating research involving rDNA, infectious agents, or human or nonhuman blood, tissues, or cells, the PI shall:

1) Make an initial determination of the required levels of physical and biological containment in accordance with the NIH Guidelines;

2) Select appropriate microbiological practices and laboratory techniques to be used for the research;

3) Working with the institutional BSO as appropriate, instruct and train laboratory staff in: (i) protocol (ii) practices and techniques required to ensure safety, and (iii) the emergency plans and procedures for handling accidental spills and personnel contamination resulting from or related to rDNA or infectious agent research;

4) Educate laboratory staff about the reasons and provisions for any precautionary medical practices advised or requested (e.g., vaccinations or serum collection);

5) Working with the institutional BSO, address all aspects of NIH Guidelines Appendix M prior to submission of a human gene transfer experiment to NIH OBA (See COMS Clinical Trial SOP).

C) During the conduct of research involving rDNA, biological agents, or human/ nonhuman blood, tissues, or cells, the PI shall:

1) Supervise the safety performance of the laboratory staff to ensure that the required safety practices and techniques are employed;

2) Investigate and report any significant problems pertaining to the operation and implementation of containment practices and procedures as outlined in the COMS Laboratory Incident Reporting SOP

3) Immediately report to the institutional BSO any work errors and conditions that may result in the release of rDNA or infectious agents and work the institutional BSO to correct any such errors or conditions.

4) Ensure the integrity of the physical containment (e.g., biological safety cabinets) and the biological containment (e.g., purity and genotypic and phenotypic characteristics) for rDNA, infectious agents, or human or nonhuman blood, tissues, or cells.
COMS Protocol Review

I. Purpose
COMS reviews and approves research at Harvard University and its affiliates that involves:

A) Recombinant DNA
B) Infectious agents (regardless of pathogenicity to humans)
C) Human and non-human primate blood, unfixed tissues or cell lines.
D) Biological toxins subject to the National Select Agent Registry Program

II. Applicability

Any COMS application that is approved by the committee must follow the guidance of this policy and the recommendations in the NIH Guidelines Section III: Experiments Covered by NIH Guidelines.

III. Implementation Procedures

A) Review Procedure for Research Involving rDNA

Research involving rDNA is covered under one of six sections (Sections III-A through III-F) of the National Institutes of Health (NIH) Guidelines for the Use of Recombinant DNA Molecules (NIH Guidelines). The review process differs depending on which section the research falls under. The Principal Investigator (PI) is responsible for submitting the completed and signed COMS protocol document to their institutional biosafety officer (BSO). The protocol document requires the PI to make an initial determination of which section of the NIH Guidelines (if any) their research falls under. The BSO then verifies that the PI’s initial determination of the NIH Guideline section is correct. If the BSO risk assessment results in the protocol requiring further review due to diversity of laboratory activities, common laboratory areas, or other concerns, further committee review may be needed.
information may be provided in the BSO Excel memo and a BSO cover letter may be required.

1) NIH Section III-A
   a. *Experiments Covered*
      i. Experiments that involve the “deliberate transfer of a drug resistance trait to microorganisms that are not known to acquire the trait naturally if such acquisition could compromise the use of the drug to control disease agents in humans, veterinary medicine, or agriculture, will be reviewed by RAC.”
   b. *Risk Assessment*
      i. The institutional BSO will conduct a risk assessment of the proposed research. See the Risk Assessment SOP. The results of the risk assessment will include:
         • *Recommended biosafety level*
         • *Containment:* The containment, procedures and, if necessary, additional stipulations for the protocol. If available, agent-specific guidance, e.g. risk group or biosafety level, from the NIH rDNA Guidelines, CDC/NIH BMBL, or Public Health Agency of Canada Pathogen Safety Data Sheets.
   c. *Committee Review*
      i. Protocols that fall under Section III-A, will be assigned at least one committee member reviewer and discussed at an upcoming COMS meeting.
      ii. Protocol initiation requires review by the NIH Recombinant DNA Advisory Committee (RAC) and approval by COMS and the NIH Director.

2) NIH Section III-B
   a. *Experiments Covered*
      i. Experiments that involve the “deliberate formation of recombinant DNA containing genes for the biosynthesis of toxin molecules lethal for vertebrates at an LD50 of less than 100 nanograms per kilogram weight.”
   b. *Risk Assessment*
      i. The institutional BSO will conduct a risk assessment of the proposed research. See the Risk Assessment SOP. The results of the risk assessment will include:
         • *Recommended biosafety level*
         • *Containment:* The containment, procedures and, if necessary, additional stipulations for the protocol. If available, agent-specific guidance, e.g. risk group or biosafety level, from the NIH rDNA Guidelines,
Committee Review

ii. Applications that fall under Section III-B, will be assigned at least one committee member reviewer and discussed at an upcoming COMS meeting.

iii. Protocol initiation requires approval by the NIH Office of Biotechnology Activities (OBA) and COMS.

3) NIH Section III-C (i.e. human gene therapy clinical trials)
   a. Experiments Covered
      i. Clinical trials that involve the “deliberate transfer of recombinant DNA or DNA or RNA derived from recombinant DNA into one or more human research participants.”
   b. Risk Assessment
      i. The BSO is responsible for providing COMS will all relevant trial information and providing an overview of the trial at the COMS meeting.
   c. Committee Review
      i. Applications that falls under Section III-C, will be assigned at least one committee member reviewer and discussed at an upcoming COMS meeting.
      ii. Protocol initiation requires approval by COMS, the local Institutional Review Board (IRB), and review by the NIH RAC (Note: if the protocol is exempt from NIH Guidelines Appendix M requirements, RAC review is not required, but COMS and IRB approval is still necessary)

4) NIH Section III-D
   a. Experiments Covered:
      i. Experiments that involve the introduction of rDNA into Risk Group 2 agents (or higher)
      ii. Experiments in which DNA from Risk Group 2 or Risk Group 3 agents is transferred into nonpathogenic prokaryotes or lower eukaryotes
      iii. Experiments involving the use of infectious DNA or RNA viruses or defective DNA or RNA viruses in the presence of helper virus in tissue culture systems
      iv. Experiments involving whole animals in which the animal's genome has been altered by stable introduction of recombinant DNA, or DNA derived there from, into the germ-line (transgenic animals) and experiments involving viable
recombinant DNA-modified microorganisms tested on whole animals
v. Experiments to genetically engineer plants by recombinant DNA methods where BL3-P containment is recommended.
vi. Experiments Involving More than 10 Liters of Culture
vii. Experiments with some strains of influenza viruses generated by recombinant methods

b. Risk Assessment
i. The institutional BSO will conduct a risk assessment of the proposed research. See the Risk Assessment SOP. The results of the risk assessment will include:
   - Recommended biosafety level
   - Containment: The containment, procedures and, if necessary, additional stipulations for the protocol. If available, agent-specific guidance, e.g. risk group or biosafety level, from the NIH rDNA Guidelines, CDC/NIH BMBL, or Public Health Agency of Canada Pathogen Safety Data Sheets.
   - If necessary, a recommendation for further committee member review

c. Committee Review
i. If Institutional BSO, Associate Director of Biological Safety, or the COMS Chair recommends further committee member review, at least one committee member reviewer will be assigned and the protocol will be reviewed at an upcoming COMS meeting.
ii. If further committee member review is not recommended, the protocol will be discussed at an upcoming COMS meeting
iii. After discussion at a COMS meeting, the BSO will send an approval letter signed by the COMS Chair to the PI indicating that work may commence under the biosafety level and stipulations indicated in the letter.

5) NIH Section III-E
   a. Experiments Covered
      i. Experiments involving the formation of recombinant DNA molecules containing no more than two-thirds of the genome of any eukaryotic virus
      ii. Experiments involving recombinant DNA-modified whole plants, and/or experiments involving recombinant DNA-modified organisms associated with whole plants where BL2-P or lower containment is recommended
      iii. Experiments involving the generation of rodents in which the animals’ genomes have been altered by stable introduction of recombinant DNA, or DNA derived there from, into the germ-line (transgenic rodents).
b. Risk Assessment
   i. The institutional BSO will conduct a risk assessment of the proposed research. See the Risk Assessment SOP. The results of the risk assessment will include:
      • Recommended biosafety level
      • Containment: The containment, procedures and, if necessary, additional stipulations for the protocol. If available, agent-specific guidance, e.g. risk group or biosafety level, from the NIH rDNA Guidelines, CDC/NIH BMBL, or Public Health Agency of Canada Pathogen Safety Data Sheets.
      • If necessary, a recommendation for further committee member review

c. Committee Review
   i. If Institutional BSO, Associate Director of Biological Safety, or the COMS Chair recommends further committee member review, at least one committee member reviewer will be assigned and the protocol will be discussed at an upcoming COMS meeting.
   ii. If further committee member review is not recommended, the BSO and the Associate Director of Biological Safety will verify that III-E is the appropriate section of the Guidelines. The BSO will email the PI that the work under section III-E may commence under the biosafety level and stipulations indicated by the BSO. The protocol will be reviewed at an upcoming COMS meeting.
   iii. After discussion at a COMS meeting, the BSO will send an approval letter signed by the COMS Chair to the PI indicating that work may continue under the biosafety level and stipulations indicated in the letter.

6) NIH Section III-F
   a. Experiments Covered
      i. Experiments involving the use of rDNA that are exempt from the NIH Guidelines
   b. Risk Assessment
      i. The institutional BSO will conduct a risk assessment of the proposed research. (See Risk Assessment policy). The results of the risk assessment will include:
         • Recommended biosafety level
         • Containment: The containment, procedures and, if necessary, additional stipulations for the protocol. If available, agent-specific guidance, e.g. risk group or biosafety level, from the NIH rDNA Guidelines,
CDC/NIH BMBL, or Public Health Agency of Canada Pathogen Safety Data Sheets.

- If necessary, a recommendation for further committee member review

c. Committee Review
   i. If Institutional BSO, Associate Director of Biological Safety, or the COMS Chair recommends further committee member review, at least one committee member reviewer will be assigned and the protocol will be discussed at an upcoming COMS meeting.
   ii. If further committee member review is not recommended, the BSO and the Associate Director of Biological Safety will verify that III-F is the appropriate section of the Guidelines. The BSO will email the PI that the work under section III-F may commence under the biosafety level and stipulations indicated by the BSO.
   iii. After review at a COMS meeting, the BSO will send an approval letter signed by the COMS Chair to the PI indicating that work may continue under the biosafety level and stipulations indicated in the letter.

B. Review Procedure for Research Not Involving rDNA

Research not involving rDNA is covered under one of two categories (infectious agents, or human or nonhuman primate materials). The review process is dependent on the risk assessment conducted by the institutional BSO and input from the Associate Director of Biological Safety and the COMS Chair.

1) Non-rDNA infectious agents
   a. Experiments Covered
      i. Experiments involving the use of non-recombinant infectious agents, regardless of their pathogenicity to humans.
   b. Risk Assessment
      i. The institutional BSO will conduct a risk assessment of the proposed research. See the Risk Assessment SOP. The results of the risk assessment will include:
         - **Recommended biosafety level**
         - **Containment**: The containment, procedures and, if necessary, additional stipulations for the protocol. If available, agent-specific guidance, e.g. risk group or biosafety level, from the NIH rDNA Guidelines, CDC/NIH BMBL, or Public Health Agency of Canada Pathogen Safety Data Sheets.
         - Agent-specific, procedure-relevant COMS precedent.
         - If necessary, a recommendation for further committee member review
c. **Committee Review**

i. If the application involves the use of Select Agents (as defined by the HHS and USDA) and/or the containment recommendation is biosafety level 3, then the application will be assigned at least one committee member reviewer and presented at an upcoming COMS meeting.

ii. If the application does not involve the use of Select Agents or BL3 containment:

   1. The Institutional BSO, Associate Director of Biological Safety, or the COMS Chair may recommend further committee member review, at which time at least one committee member reviewer will be assigned and the protocol will be discussed at an upcoming COMS meeting.

   2. If further committee member review is not recommended, the BSO and the Associate Director of Biological Safety will verify that the protocol does not involve rDNA. The BSO will email the PI that the work may commence immediately under the biosafety level and stipulations indicated by the BSO. The protocol will be discussed at an upcoming COMS meeting.

   3. After discussion at a COMS meeting, the BSO will send an approval letter signed by the COMS Chair to the PI indicating that work may continue under the biosafety level and stipulations indicated in the letter.

2) **Human and non-human primate blood, unfixed tissues or cell lines**

   a. **Experiments Covered**

      i. Experiments involving the use of human and non-human primate blood, unfixed tissues or cell lines.

   b. **Risk Assessment**

      i. The institutional BSO will conduct a risk assessment of the proposed research. See the Risk Assessment SOP. The results of the risk assessment will include:

         * **Recommended biosafety level**
         * **Containment**: The containment, procedures and, if necessary, additional stipulations for the protocol. If available, agent-specific guidance, e.g. risk group or biosafety level, from the NIH rDNA Guidelines, CDC/NIH BMBL, or Public Health Agency of Canada Pathogen Safety Data Sheets.

         * If necessary, a recommendation for further committee member review

   c. **Committee Review**
i. The Institutional BSO, Associate Director of Biological Safety, or the COMS Chair may recommend further committee member review, the protocol will be discussed at an upcoming COMS meeting.

ii. If further committee member review is not recommended, the BSO and the Associate Director of Biological Safety will verify that the protocol does not contain rDNA. The BSO will send an approval letter signed by the COMS Chair to the PI indicating that work may commence under the biosafety level and stipulations indicated in the letter.

3) Biological toxins subject to the National Select Agent Program
   a. Experiments Covered
      i. Experiments involving the use of biological toxins subject to the National Select Agent Registry Program.
   b. Risk Assessment
      i. The institutional BSO will conduct a risk assessment of the proposed research. See the Risk Assessment SOP. The results of the risk assessment will include:
         - Recommended biosafety level
         - Containment: The containment, procedures and, if necessary, additional stipulations for the protocol. If available, agent-specific guidance, e.g. risk group or biosafety level, from the NIH rDNA Guidelines, CDC/NIH BMBL, or Public Health Agency of Canada Pathogen Safety Data Sheets.
         - If necessary, a recommendation for further committee member review
   c. Committee Review
      i. The Institutional BSO, Associate Director of Biological Safety, or the COMS Chair may recommend further committee member review, the protocol will be discussed at an upcoming COMS meeting.
      ii. If further committee member review is not recommended, the BSO and the Associate Director of Biological Safety will verify that the protocol does not contain rDNA.
      iii. For non-rDNA applications that don’t require further review, the COMS application submitted serves as a record and work can commence prior to the next meeting. For rDNA applications or those that require reviewer, work may not commence until after COMS vote has occurred.
V. Policy Authority
   The Committee on Microbiological Safety shall enforce this policy.

   a. Related Policies
      COMS Risk Assessment Policy
      COMS Clinical Trial Policy

VI. References

   A. NIH rDNA Guidelines

   B. CDC/NIH BMBL 5\textsuperscript{th} edition (see Table 2)
      http://www.cdc.gov/biosafety/publications/bmbl5/

   C. CDC/USDA Select Agent Regulations
      http://www.selectagents.gov/
Risk Assessment Policy

I. Purpose

The purpose of this policy is to define risk assessment and what is required for each application submitted to COMS.

II. Applicability

Any COMS application that will be reviewed by the committee must follow the guidance of this policy and the recommendations in the NIH Guidelines Section IIA Risk Assessment.

III. Definitions

A. Biological Agent:

Potentially infectious materials or recombinant agents that are classified as Risk Group1-3 of the NIH rDNA Guidelines.

B. Risk assessment:

Risk assessment is a process used to identify the hazardous characteristics of a known infectious or potentially infectious agent or material, the activities that can result in a person’s exposure to an agent, the likelihood that such exposure will cause a LAI, and the probable consequences of such an infection. The information identified by risk assessment will provide a guide for the selection of appropriate biosafety levels and microbiological practices, safety equipment, and facility safeguards that can prevent LAIs (BMBL 5th Ed., Section II, p.21).

IV. Implementation procedures
A. General Information

Institutional Biosafety Officers (BSO) must perform a qualitative biological risk assessment (RA) of all proposed research protocols involving biological agents or recombinant DNA (rDNA) agents. All projects are subject to COMS review and approval. The information to be considered in the RA is elaborated below in section B. Additionally, based on the conclusions drawn in the RA, the BSO may recommend that the proposed protocol receive additional review by a COMS committee member. This process is outlined in the COMS Protocol Review SOP.

B. Procedure:

The following is a list of hazards associated with rDNA and biological agents, categories of risk, and contents of the risk assessment. These should all be considered in the RA, as applicable:

1. Factors influencing hazard of the agent (as applicable)
   - Pathogenicity
   - Host range
   - Infectious dose (may differ based on route of transmission)
   - Agent stability
   - Concentration of agent
   - Animal study data
   - Effective treatment/prevention (e.g., availability of antibiotics or vaccine)
   - Origin of agent (e.g., academic laboratory, commercial source)
   - Strain validation
   - Predominate route(s) (Note: route(s) of exposure in laboratories may differ than routes of transmission observed in nature)
   - Delivery of genetic material to cell independently (e.g., viral vector) cells

2. Experimental category (as applicable):
Transferring antibiotic resistance (Section III A)

Creation of a toxin molecule less than 100ng/kg (Section III B)

Experiments involving the deliberate transfer of rDNA or derived, into one or more human research participants. (Section III C)

Using risk group agents as host-vector systems (Section III D1)

Experiments involving rDNA from risk group agents and transferring into nonpathogenic prokaryotes or lower eukaryotes (Section III D2)

Experiments involving use of infectious rDNA or RNA viruses or Defective DNA and RNA viruses in the Presences of Helper virus in Tissue Culture Systems (Section III D 3)

Experiments involving whole animals (Section III D 4)

Experiments involving whole plants (Section III D 5)

Experiments involving more than 10 liters of culture (Section III D6)

Experiments involving influenza virus (Section III D 7)

Experiments involving formation of rDNA molecules containing no more than 2/3 of the genome of any eukaryotic virus (Section III E)

3. Contents of the Risk Assessment (as applicable):

- Risk Group
- Biosafety Level
- Safety features to reduce risk of replication-competent generating viruses (e.g., genes separated into different plasmids, deletion of 3’LTR (i.e., self-inactivating))
- Expression of Tat (Tat is a transcriptional activator responsible for high replication rates)
- Viral DNA integration into the host genome
- Gene insert (e.g., oncogenic, toxin, altering of cell cycle)
- Tropism (ability to infect human cells)
- Human and Old World Non Human Primate cell and/or tissue use
• Review of sharps in use and safe sharp alternatives
• Generation of aerosols (e.g., centrifugation, cell-sorting)
• Unique procedures/equipment
• Large volume work [greater than 10L or high concentration of biological organism (greater than $10^6$ agent)]
• Animal involvement:
  • Type of animal
  • Potential for animal activity to generate aerosols
  • Infectious agent shedding
  • Handling (e.g., bites, scratches, allergens)
  • Use of a permissive host, engraftment of permissive cells

4. *Hazards associated with materials containing unknown infectious agents (e.g., clinical samples, cell culture)* (as applicable)
   • Source of material
   • Suspected or potential infectious agent(s)
   • Availability of medical or epidemiologic data (e.g. morbidity or mortality rates)
   • Potential route of transmission

C. Laboratory / Containment:
   • Space and facilities available
   • Training and experience of staff
   • Qualifications of those utilizing the agent,
   • Laboratory design consistent with BMBL biological containment levels and risk group levels for the organism(s) in use
   • Laboratory procedures consistent with BMBL work practices for the recommended biological containment level
• Ability to contain unique equipment or procedures

D. Policy Authority
The Committee on Microbiological Safety shall enforce this policy.

E. Related Policies
   a. COMS Protocol Review Policy

VII. References
B. NIH Risk Group Classifications (see Appendix B)
C. CDC/NIH BMBL 5th edition (see Appendix C)
   http://www.cdc.gov/biosafety/publications/bmbl5/
Incident Reporting Policy

I. Purpose

This policy outlines the incident reporting requirements for Principal Investigators, Biosafety Officers, and institutions whose recombinant DNA and/or biological work is covered by the Committee on Microbiological Safety.

II. Applicability

Any COMS application that is approved by the committee must follow the guidance of this policy and the recommendations in the NIH Guidelines.

III. Definitions

A. Biological Agent:
   Potentially infectious materials or recombinant agents that are classified as Risk Group 1-3 of the NIH rDNA Guidelines.

B. Biological agent incident:
   Any incident involving a biological agent. These incidents must be reported to COMS. Local health departments (Boston Public Health Commission and/or Cambridge Biosafety Committee) may also require the reporting of a biological agent. Please refer to Appendix D: Regulatory Agency Reporting Procedure for further procedures on reporting to health departments including lists of reportable biological agents.

C. Recombinant DNA Incident:

   Section IV-B-2-b-(7) of the NIH Guidelines states that IBCs should report "...any significant problems, violations of the NIH Guidelines, or any significant
research-related accidents and illnesses" to NIH OBA within 30 days. Appendix G of the NIH Guidelines specifies certain types of accidents that must be reported on a more expedited basis. According to NIH Guidelines Appendix G-II-B-2-k, spills or accidents in BL2 laboratories resulting in an overt exposure must be immediately reported to NIH OBA (as well as the IBC). According to NIH Guidelines Appendix G-II-C-2-q and Appendix G-II-D-2-k, spills or accidents occurring in high containment (BL3 or BL4) laboratories resulting in an overt or potential exposure must be immediately reported to NIH OBA (as well as the IBC, and BSO). Local health departments under COMS (City of Boston and Cambridge) also require reporting recombinant DNA incidents. (See Tables 1 and 2 below).

D. Potential Exposure:
A possible personal contact with a Biosafety Level Three (BL3) recombinant biological agent. According to the NIH rDNA guidelines, this contact would be reportable to NIH Office of Biotechnology Activities (NIH OBA). Examples of potential exposures to a BL3 agent are any accidents, equipment failure, or splash to intact skin.

E. Overt Exposure:
A definitive contact with a Biosafety Level Two or Biosafety Level Three recombinant biological agent. According to the NIH rDNA guidelines, this contact would be reportable to NIH Office of Biotechnology Activities (NIH OBA). Examples of overt exposures are needle sticks and splashes of rDNA agent on personnel.

IV. Implementation procedures
A. Responsibilities

1) Principal Investigator:
As stated in the Memorandum of Understanding and Agreement, signed by the Principal Investigator (PI) of COMS-approved research, PIs are required to report potential or overt exposures to rDNA agents and/or biological agents to their Institutional Biological Safety Officer (BSO). Additionally, the NIH Guidelines state that reporting of accidents or illnesses to the NIH is the responsibility of the PI, the BSO and the Institutional Biosafety Committee (IBC). This policy mandates the reporting through the BSO. The following excerpts from the COMS application memorandum highlight the PI requirements under this policy:

"By signing this document I agree to immediately notify COMS if a member of the laboratory staff develops symptoms of illness related to an agent involved in this study and if there is accidental release of a biohazardous agent into the environment."
And in a separate paragraph, “By signing this document I accept full responsibility for laboratory biosafety training, for the maintenance of a safe workplace and for immediate reporting of accidental exposures to biohazardous agents.”

2) Biosafety Officer:
As stated above, the biosafety officer is responsible for reporting any incident involving recombinant DNA (rDNA) agents and/or biological agents to COMS and to the appropriate government agencies, as listed under Appendix E. In some cases, an entity may designate an institutional responsible official to complete said reporting. The BSO is also responsible for presenting any incident and corrective action plans that have proceeded each COMS meeting.

3) COMS:
The committee is responsible for reviewing and discussing incidents at each committee meeting and ensuring that each institution has complied with all applicable regulations for incident reporting. The committee also requires that each Principal Investigator comply with all applicable regulations for incident reporting.

B. Reporting Considerations
1) Procedure
   a. Personnel involved in any personal potential or overt exposure must be provided all appropriate medical evaluation and surveillance.
   b. The BSO or duly designated representative will notify the Associate Director of Biological Safety and/or the COMS Chair the initial details of the incident. The BSO, or duly designated institutional official, will then notify all appropriate regulatory agencies as specified in Appendices D and E. Notification of the agencies should take place in accordance with reporting requirements as specified in Appendix D.
   c. BSO should investigate the incident to identify route cause, training needs, and corrective action measures.
d. A verbal summary of the incident shall be provided by the BSO at the next scheduled COMS meeting and will be recorded in the meeting minutes.

e. For incidents involving laboratory acquired infections, breach of containment or overt exposures, and/or violations of the COMS approval, (or lack thereof), PIs must prepare a written response detailing the laboratory event and corrective actions taken to mitigate the event. The letter should be submitted to COMS one week prior to the next scheduled COMS meeting so that it can be discussed during the meeting. COMS will document its review in the meeting minutes.

2) Reporting of Significant reporting events:(See Appendix D)

a. Spills and accidents which result in overt exposures to any organisms containing rDNA and/or BL2 or BL3 biological agents must be immediately reported.

b. Illnesses and/or symptoms potentially related to rDNA and/or biological agents in use in the BL3 laboratory must be immediately reported.

c. Breach of BL3 containment which results in potential or overt exposures to organisms containing rDNA and/or biological agents released into the environment must be immediately reported.

d. Breach of containment resulting from failure of mechanical systems (e.g. HVAC, loss of power) and laboratory equipment (Biosafety cabinet, centrifuge, ventilated animal cages) must be immediately reported.

3) Reporting of Incidents at the COMS meeting:

BSO should provide verbal report, which shall include, but not limited to, the following:

a. The nature of the incident (e.g. personnel exposure, spill, loss of containment, loss of transgenic animal, failure to obtain IBC approval, failure to follow approved containment conditions, other)

b. The COMS approval number

c. Federal, state or local agencies to which incident is being reported

d. A description of the incident, including the following information:
   i. The recombinant agent or material involved. (if applicable)
ii. The incident/violation location (e.g. laboratory biosafety level, vivarium, non-laboratory space).

iii. The person(s) involved in the incident/violation, including others present at the incident location. [position title only] (e.g., graduate student, post doc, animal care worker, and facility maintenance worker).

iv. Actions taken immediately following the incident/violation to limit any health or environmental consequences of the event, as well as the [position titles] of the individual(s) who took those actions.

v. The training received by the individual(s) involved and the date(s) the training was conducted.

vi. The institutional or laboratory standard operating procedures (SOPs) for the research and a determination of whether there was any deviation from these SOPs at the time of the incident/violation.

vii. Any deviation from the COMS-approved containment level or other COMS approval conditions at the time of the incident/violation.

viii. The personal protective equipment in use at the time of the incident/violation.

ix. The occupational health requirements for laboratory personnel involved in the research.

x. Any medical treatment/surveillance provided after the incident.

xi. Any injury or illness associated with the incident.

xii. Any equipment failures that occurred.

xiii. Any other relevant information identified during the review/investigation of the event

xiv. Measures taken by the Institution to mitigate identified problems (e.g., review by COMS, root cause analysis)

4) Multi-institutional research:
There may be circumstances where Principal Investigators are collaborating with other institutions that are not covered by COMS. The Principal Investigator must report to their BSO any incident that occurs under a COMS protocol. PIs should
be aware that they may have additional reporting obligations to other institutions should their work be registered at other Institutional Biosafety Committees (IBCs).

VI. Policy Authority
The Committee on Microbiological Safety shall enforce this policy.

a. Related Policies

VI. References

A. NIH rDNA Guidelines


B. CDC/NIH BMBL 5th edition (see Table 2)

http://www.cdc.gov/biosafety/publications/bmbl5/
POLICY ON MINUTES OF IBC MEETING

I. Purpose

To describe the policy for completing the minutes of convened meetings of the Harvard University Institutional Biosafety Committee, commonly referred to as COMS (Committee on Microbiological Safety).

II. Applicability

The NIH Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines) require that IBC minutes and documents be made available to the public on request. (Section IV-B-2-a-7) The NIH Office of Biotechnology Activities has issued two documents pertaining to minutes (Q&A 5/14/04; Guidance Memo 2/23/07). Where there are discrepancies in Robert’s Rules of Order Newly Revised and Guidance from NIH, NIH Guidance is followed. In order to ensure consistency, the following is adopted.

III. Definitions

A. Principal Investigator:

The Principal Investigator (PI), or also known as a Project Director or Program Director, is one or more individuals designated by the institution to direct the project or program supported by the NIH grant. Having more than one PI does not diminish the responsibility of the individual PI. On behalf of the institution, the PI(s) is responsible for full compliance with the NIH Guidelines in the conduct of recombinant DNA research.

B. Office of Biological Safety:

The Office records and ensures timely review of public comments and reports comments and COMS response to the NIH OBA and institutions supported by COMS.
IV. Implementation procedures

Information in the minutes must document that COMS has fulfilled its obligations for review and oversight of projects as noted in section IV-B-2-b of the *NIH Guidelines*. The Committee’s rationale for particular decisions is clear.

Detail will exceed the standard set in *Robert’s Rules*. Minutes will document the date and place of the meeting, whether minutes of the prior meeting were approved, whether and why the meeting was open or closed, all major motions, whether the motions were approved and the time of adjournment. Structure of the minutes will reflect the agenda.

Specifically;

- Attendance will include voting members, ex-officio members, ad-hoc reviewers, consultants, Principal Investigators and guests.
- Members who recuse themselves from discussion or voting on a review due to a conflict of interest.
- Members who leave the meeting for any reason. Quorum must be maintained.
- Members who attended the meeting under discussion may offer modifications to minutes before the IBC.
- Section of the NIH Guidelines pertinent to the research involved in recombinant DNA applications.
- Technical information related to the proposed project:
  - Host(s) and vector(s) to be used
  - Agent characteristics such as virulence and pathogenicity.
  - Function of the inserted DNA sequence
  - Types of manipulations
  - Containment conditions to be implemented

Distribution of Minutes

- Office of Biological Safety staff distribute draft minutes as part of the COMS agenda for the meeting at which minutes are scheduled to be approved.
- Those present at the convened meeting may submit corrections to the Office of Biological Safety office prior to the meeting as well as during the meeting. The Office staff may correct administrative errors as appropriate.
- Distribution of approved minutes is through Office of Biological Safety.
  - Minutes are submitted to regulatory agencies by this office and distributed to each institution.
  - Other requests for minutes are also processed by this office. Note that the *NIH Guidelines* require meeting minutes be available to the public on request.
COMS Provision of Public Comments to the NIH Office of Biotechnology Activities

In accordance with the NIH Guidelines, COMS shall allow for public review of its actions through the provision of meeting minutes to those that have requested such documentation. COMS, in consultation with the appropriate institutional Biosafety Officer and Office of General Counsel, shall review and respond to all written public comments received in response to public review of meeting minutes in a manner that is consistent with any redaction policy noted in these policies and procedures. Public comments and COMS’ response shall be forwarded in writing to the NIH Office of Biotechnology Activities by the Associate Director of the Office of Biological Safety in a timely manner at the below address:

National Institutes of Health
6705 Rockledge Drive, Suite 750, MSC 7985
Bethesda, MD 20892-7985 (20817 for non-USPS mail)

NIH guidelines require COMS to provide copies of its minutes to any member of the public, respond to public comments received, and report such comments and COMS’ response to the NIH. In addition the guidelines encourage COMS to have its meetings open to the public.

V. Policy Authority:

The Office of Biological Safety of the Harvard Medical School is responsible for supporting the Committee on Microbiological Safety. This includes preparation of IBC meeting minutes as well as the associated record keeping.

VI. Related Policies

- POLICY ON REDACTING MINUTES OF IBC MEETING

VII. References
POLICY ON REDACTING MINUTES OF IBC MEETING

I. Purpose
To describe policy for redacting the minutes of convened meetings of the Harvard University Institutional Biosafety Committee, commonly referred to as COMS (Committee on Microbiological Safety).

II. Applicability
The NIH Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines) require that IBC minutes and documents be made available to the public on request. (Section IV-B-2-a-7) The previous Section (IV-B-a-2-6) acknowledges that the protection of privacy and proprietary interests is sufficient to redact portions of minutes. The NIH Office of Biotechnology Activities has issued two documents pertaining to minutes (Q&A 5/14/04; Guidance Memo 2/23/07). In order to ensure redaction is performed consistently, the following procedure is adopted.

III. Definitions
A. Principal Investigator:
The Principal Investigator (PI), or also known as a Project Director or Program Director, is one or more individuals designated by the institution to direct the project or program supported by the NIH grant. Having more than one PI does not diminish the responsibility of the individual PI. On behalf of the institution, the PI(s) is responsible for full compliance with the NIH Guidelines in the conduct of recombinant DNA research.

B. Office of Biological Safety:
Records and ensures timely review of public comments. Reports comments and COMS response to the NIH OBA and institutions.
IV. Implementation Procedures

A. Information not redacted:

- Names of guests present at meetings.
- Statement that members recuse themselves from discussion/voting due to a conflict of interest.
- Basic information related to risk assessment and containment levels required by the *NIH Guidelines* for proposed research

B. Information not released to the Public:

- Home telephone numbers and home addresses of COMS members
- Information that is likely to compromise institutional security.
- Whether and/or where Select Agent work is ongoing.
- Trade secret or other confidential information
- Principal investigator names
- Laboratory locations
- COMS members names
- Proprietary information is received from sponsors of clinical gene transfer studies
- Proprietary information is received from investigators with patents pending.
- Proprietary information related to personal matters.

**COMS Provision of Public Comments to the NIH Office of Biotechnology Activities**

In accordance with the NIH Guidelines, COMS shall allow for public review of its actions through the provision of meeting minutes to those that have requested such documentation. COMS, in consultation with the appropriate institutional Biosafety Officer and Office of General Counsel, shall review and respond to all written public comments received in response to public review of meeting minutes in a manner that is consistent with any redaction policy noted in these policies and procedures. Public comments and COMS’ response shall be forwarded in writing to the NIH Office of Biotechnology Activities by the Associate Director of the Office of Biological Safety in a timely manner at the below address:

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NIH guidelines require COMS to provide copies of its minutes to any member of the public, *respond to public comments received, and report such comments and COMS’ response to the NIH*. In addition the guidelines encourage COMS to have its meetings open to the public.
V. Policy Authority
The Office of Biological Safety of the Harvard Medical School is responsible for supporting the Committee on Microbiological Safety. This includes preparation of IBC meeting minutes as well as the associated record keeping.

VI. Related Policies
a. POLICY ON MINUTES OF IBC MEETING

VII. References
Policy for Validating Attenuated Strains of BL3\(^1\) Organisms

Purpose: To verify the identity of attenuated strains of BL3 organisms prior to receipt.

Applicability: This requirement to validate strains applies to all BL3 agents. Select agents must be validated by NERCE. Non-select agent BL-3 strains can be tested in other labs and documentation must be provided to the institutional biosafety officer for review by COMS.

III. Implementation Procedures
A) Possession and research involving attenuated BL3 organisms must be approved by COMS.

B) Validation.

1) Until attenuation is validated all experiments with attenuated BL3 organisms must take place at BL3 unless lesser containment is approved by COMS.
   i. Harvard has no BL4 laboratories. Hence attenuated BL4 agents cannot be validated at Harvard.
   ii. Validation procedures must be approved by COMS.
   Approval by two reviewers with the necessary expertise will suffice.
   iii. Validation must be carried out in an approved COMS registered laboratory equipped for and experienced with strain validation.
   iv. Documentation of validation testing must be submitted to COMS or NERCE/BEID for approval and permanent archiving.

2) After the initial validation, it is recommended the attenuated BL3 organism be grown and aliquoted in quantities sufficient for use until the project is completed. This will be the seed stock for future cultures.
   i. Attenuated BL3 organisms must be stored in a secured, limited access facility.
   ii. A detailed, legible, log of their use must be kept by the investigator.

C) Maintenance. Ensuring attenuated strains remain attenuated over long periods.

2) Vials of Seed Stock and Working Stock derived from Seed Stock should be sterilized and discarded after a single use.

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\(^1\) An attenuated BL3 organism is one that can be safely used at BL2 or (rarely) BL1 containment and procedures.
i. Hence numerous aliquots should be generated by the receiving laboratory.
ii. Working Stock must be derived only from Seed Stock.
iii. When Seed Stock is nearly exhausted a sample of Master Stock can be obtained from NERCE/BEID.

   1. Revalidation is also acceptable if Master Stock is not available.

D) Transfer to another Laboratory.
2) Attenuated BL3 organisms or their derivatives may not be transferred to another laboratory without COMS approval.
3) Attenuated BL3 Select Agents or their derivatives may not be transferred to other laboratories.

   i. Only NERCE/BEID is permitted to distribute attenuated Select Agents.

E) Failure to comply with these provisions may be the basis for disciplinary action.

III. Policy Authority
The Committee on Microbiological Safety shall enforce this policy.

VII. Related Policies

VII. References
COMS Policy on Clinical Trial Studies

I. Purpose:
Investigators must obtain approval from COMS before administering recombinant DNA, xenotransplantation materials or biological agents to human subjects.

II. Applicability:
All investigators that conduct work or are employed by a COMS-affiliated institution must have approval from COMS for any clinical trial involving human gene transfer, human xenotransplant, xenograft, or biological agents.

IV. Definitions:
A) Human Gene Transfer Studies: Research involving the deliberate transfer of recombinant DNA or RNA derived from recombinant DNA into human subjects. NOTE: All human gene transfer studies must be submitted for evaluation to the NIH Office of Biotechnology Activities, Recombinant Advisory Committee (RAC). COMS cannot approve a Human Gene Transfer study until the RAC has made a determination.

B) Human Xenotransplants and Xenografts: Research and investigational therapeutic approaches involving the transfer of organs, tissue, or cells of animal origin into human subjects. Ex vivo use of animal tissue or cells for treating human subjects in a manner that may result in infectious agents being passed to human subjects.

C) Biological Agents in Human Subjects: Investigational treatment of human subjects with biological agents, whether they are potentially pathogenic or not must be reviewed by COMS.

IV. Implementation Procedures

A) Clinical Trial documents for submittal to Committee:
i. Clinical Protocol  
ii. Investigator’s Brochure  
iii. Informed Consent Form  
iv. COMS Clinical trial application form  
v. *NIH Guidelines for Research Involving Recombinant DNA Molecules* (September 2009), Appendix M for gene transfer studies, “Points to Consider in the Design and Submission of Protocols for the Transfer of Recombinant DNA Molecules into the Genome of One or More Human Subjects.”  
vi. NIH/OBA RAC letter of review and comments

NIH regulations require Institutional Biosafety Committees await action by the NIH Recombinant DNA Advisory Committee (RAC) before approving and human study involving DNA transfer. The RAC can simply pass the protocol to the FDA or it can decide to evaluate the proposal at its next quarterly meeting. This procedure can delay study approval by as much as six months. However, if an investigator sends a Gene Transfer protocol to COMS at the same time as it is sent to the RAC, local approval can come immediately after the RAC acts.

B) Biosafety information:  
The Institutional Biosafety Officer will submit the above study documents with a memo table with the following items: a) summarizing the study, b) outlining the biosafety issues involved with the gene transfer product, c) listing any similar studies approved by COMS d) description of study adverse event reporting procedure (NIH, FDA, IRB, and COMS) and the presence of a Data Safety Monitoring Board (DSMB).

C) Review process:  
In consultation with the institutional Biosafety Officer the Associate Director of the Office of Biological Safety/COMS Chair decides on one of three courses of action:

1) For completely novel procedures the application material is sent to every COMS member. Two members are selected to review the material in depth and report to the committee at its next meeting. At the COMS meeting a decision is taken as to approval, approval with stipulations, decline, or reject.

2) For studies with ample precedent faster approval is likely. One COMS member is assigned to review the study. The recommendation can be for initial approval, further
review or discussion by COMS at its next meeting. In all cases the COMS chair has the responsibility of accepting the recommendation or choosing another path.

3) Finally, studies deemed to have low risk and some (but not “ample”) precedent will be sent to two COMS members for their recommendations.

4) All material relating to clinical studies must be submitted to the Office of Biological Safety 6 weeks prior to the next COMS meeting.

D) Approved Clinical Trials:
Human trials involving gene transfer or xenotransplantation are approved for one year. No research participant shall be enrolled at a clinical trial site until the following documentation is provided below as follows:

1) Safety Reporting
Reporting to COMS Serious Adverse Events (SAE)
Principal Investigators must submit a written report on any serious adverse events that is both unexpected and associated with the use of gene transfer product. Investigators should also report events where there is a reasonable possibility that the product may have caused the event. Reporting is required for any finding from tests in laboratory animals that suggests a significant risk for human research participants including reports of mutagenicity; teratogenicity, or carcinogenicity.

This report labeled “safety report” must be submitted to NIH OBA as soon as possible, but not later than after the sponsor’s initial receipt of the information 7 days for serious adverse events that result in death or considered life-threatening. Serious adverse events that do not result in death or considered life-threatening should be reported as soon as possible, but no later than 15 days after the sponsor’s initial receipt of the information. It should be noted that the event must be reported concurrent to the FDA.

Principal Investigators may delegate to another party, such as the corporate sponsor, the reporting functions set forth in NIH Guidelines, Appendix M, with written notification to the NIH OBA. A copy of this written notification to NIH must be provided to COMS. The Principal Investigator is still responsible for notifying COMS of any serious adverse events through the institutional Biosafety Officer as described above. SAEs that do not require reporting are those that are considered unrelated to the study drug or fall out of reporting requirements with the institutional review board(s) that are overseeing the study.

Reporting to other Committees and Regulatory Agencies
Principal Investigators should adhere to any other serious adverse event reporting requirements in accordance with federal regulations, state laws, and local institutional policies and procedures, as applicable.

Specific Institutional Review Board may have additional requirements for adverse event reporting. Dana Farber /Harvard Cancer Institute (DF/HCC) studies (including multi-center trials) must report SAEs as soon as possible, but no later than 10 working days from notification of event on the DFCI IRB SAE Reporting form.

2) Annual Renewals
Clinical studies are approved for one year only. A renewal is necessary to proceed. Renewals involve submittal of renewal report form of the year’s activities and results. Renewals are required during the follow-up phase. The form can be found at http://www.hms.harvard.edu/orsp/coms/forms.htm. The PI can adjust the renewal timing to correspond with annual reports to other Committees and Agencies (i.e. IRB and FDA).

A current Data Safety Monitoring Board (DSMB) report can be substituted for a renewal report form. Renewal for the subsequent year will be required one year after the date of the DSMB report.

3) Clinical Holds
Investigators must immediately notify COMS of an FDA required hold. In general the COMS approved clinical study will automatically go on COMS hold as well. A release of the FDA hold does not automatically constitute a release by COMS. Rather, the circumstances necessitating the original hold and the extenuating information resulting in its release will be provided to the COMS Chair through the institutional Biosafety Officer. The Chair will determine whether the issues require committee discussion or if a release of the hold can go forward.

4) Amendments to approved clinical protocols
Clinical protocol amendments are processed much in the same way as original submissions, without the necessity of submitting a formal application. A short letter or e-mail describing the additions and changes is usually all that is necessary. The institutional Biosafety Officer then evaluates the changes and decides whether the changes require a new application. If not, the Biosafety Officer generates a memorandum to the Committee Chair outlining the changes and recommending initial approval or full committee action.

5) Protocol Closures
Clinical trials that are being closed require notification from the PI to COMS. A clinical trial is considered completed by COMS under the following circumstances:

- Only data analysis is being conducted
- Study follow up is only to confirm long-term survival
- Patients are no longer receiving study drug or follow up and
- There is no further study enrollment of new patients
- Research samples from the patients are no longer being analyzed by laboratories

V. Policy Authority
The Committee on Microbiological Safety shall enforce this policy.

VI. Related Policies to Clinical Trials

A. Principal Investigator Responsibilities:
The Principal Investigator for a clinical trial is solely responsibility for its conduct. It is COMS policy that all materials, documents and other formal communications relating to a proposed human gene transfer or xenotransplantation study come from the Principal Investigator, not the sponsor. It is the responsibility of the Principal Investigator to be fully informed about issues that pertain to the safe conductance of his/her study. Hence, all written responses to Committee queries must be submitted on the Principal Investigator's letter head and must be signed and dated by the Investigator. Signature stamps and signatures by others in the Investigator's name are not acceptable. All communications between a study sponsor and COMS must go through the Principal Investigator. The sponsor may not communicate directly with COMS. Investigators must provide annual updates and reports to the COMS concerning the progress of clinical trials. Investigators are required to train clinical staff about the risks associated with the study, about safe procedures and the proper use of safety equipment

B. Multiple Clinical Sites:
Many clinical studies involve multiple centers. When two (or more) centers fall under the COMS umbrella an application from a Principal Investigator at each institution is expected. However, identical protocols from different institutions can be considered together and approval for one will be approval for all. Each PI should submit a COMS application and they will be assigned a related protocol number (e.g. 11-100a, 11-100b…) and will be reviewed as a group.

C. Referrals to Human Gene Transfer and Xenotransplantation Trials at External Institution:
For human gene transfer and human xenotransplantation studies in which investigators associated with Harvard affiliated institutions recruit and follow participants but do not administer the test article will be fully reviewed by COMS. This means the Harvard institution must submit: a copy of the remote site IBC and IRB approvals, a completed COMS application form covering the entire study, a completed NIH recombinant DNA Guideline Appendix M (if required by the NIH), a completed FDA protocol, an FDA investigator's brochure, informed consent forms for both sites, NIH biosketches of investigators at the non-Harvard institution, and a description of the facilities involved. COMS will defer or reject the application, if deficient. In a mirror situation, one in which the drug or tissue is administered in a Harvard Institution but recruitment and follow-up are done elsewhere, COMS will not require NIH biosketches of investigators at the non-Harvard institution or a description of the facilities involved.

D. Tissue Processing Laboratories for Human Trials
   It is COMS policy that processing of eukaryotic cells or tissues modified with recombinant DNA and destined for human recipients must be carried out in a laboratory accredited, or, in special cases, is actively seeking accreditation, by an independent, outside, clinical organization appropriate to the manipulations.

E. Laboratory Studies Closely associated with Clinical Studies
   Research laboratory studies in support of a clinical study carried out in a hospital setting on materials taken from a clinical study can be registered with COMS or, if the Biosafety Officer deems it appropriate, responsibility can be placed with the hospital’s infection control unit. In the latter case the Infection Control Unit will take full responsibility for technician safety and training.

F. Cooperative Arrangement with Dana-Farber Cancer Institute
   The Dana-Farber Cancer Institute (DFCI) is not covered by COMS. DFCI has its own Biosafety Committee - the Biohazard Control Committee (BCC). On occasion COMS and the BCC are asked to approve the same gene transfer protocol. Principal Investigators will have submitted applications to the IBC serving their institution that include an identical IRB protocol, Investigator’s Brochure and Appendix M plus an institution specific application form.

VII. References

NIH Guidelines Appendix M
GUIDELINES FOR MICROBIOLOGIC SAFETY IN CLINICAL TRIALS INVOLVING XENOTRANSPLANTATION

I. Purpose
The goals of the Xenotransplantation Advisory Committee (XTAC) include the protection of subjects in clinical trials of xenotransplantation (XT), protection of the community at large, and the facilitation of such studies whenever possible. These goals are not contradictory. However, adherence to optimal safety practices will always take precedence when these goals come into conflict.

II. Applicability
All laboratories with or seeking COMS approval for work involving xenotransplantation.

III. Definitions
A) Xenotransplantation: any study in which human tissues (including blood) come into contact (in vivo or ex vivo) with non-human fluids, cells, tissues, or organs. This includes cells or tissues intended for human uses that contact nonhuman cells in vitro (e.g., stem cells cultured with murine feeder cells).
B) Porcine endogenous retrovirus (PERV-A, B, and C): a family of C type retroviruses with some infectivity for human cell lines. No active infection of humans exposed to porcine tissues has been identified to date.
C) Porcine cytomegalovirus (PCMV): a herpes virus without known infectivity for human cells
D) Porcine gammaherpesvirus: (PGHV) an agent associated with post-transplant lymphoma in immunosuppressed swine.
E) Porcine circovirus: of unknown infectivity

IV. Implementation Procedures
A) General Concerns:
A central concern for any human study of XT is the possible introduction of novel infectious agents into the subjects and, subsequently, into their sexual and social contacts. This possibility has been reviewed extensively in the literature. For example, a number of potential pathogens have been described in swine including, but not limited to:

1. Porcine endogenous retrovirus (PERV-A, B, and C): a family of C type retroviruses with some infectivity for human cell lines. No active infection of humans exposed to porcine tissues has been identified to date.
2. Porcine cytomegalovirus (PCMV): a herpes virus without known infectivity for human cells
4. Porcine circovirus: of unknown infectivity

Many common pathogens of humans including mycobacteria, common bacteria (e.g., *S. suis* and *Salmonella* spp.), parasites (*Toxoplasma gondii*), fungi (*Aspergillus* spp.) The risk of infection due to each of these organisms is unknown and immeasurable for XT procedures. Thus, the FDA has developed guidelines and restrictions for the performance of such trials including sample archiving from donor animals and recipients, testing for a variety of infectious agents, and lifelong surveillance of recipients of xenogenic tissues (http://www.cdc.gov/mmwr/PDF/rr/rr5015.pdf). It is the responsibility of each investigator to become familiar with relevant regulations and background materials and to assure that each protocol will adhere to these guidelines.

B) Specific Concerns:
1) The sponsor must ensure that appropriate counseling is provided to subjects and their close contacts (family and or sexual partners) to minimize the potential risk of transmission of infectious agents to social and sexual contacts (see pages 5, 17 and 18 of guidance document). Subjects must be required to agree to barrier protection during sexual contacts and to report unexplained illnesses after XT. Subjects must also educate close contacts and relatives regarding potential risks. Pregnancy and unprotected sexual contacts are central concerns regarding the possible transmission of pathogens to a fetus (potentially via germ line transmission), to sexual contacts, and to society.

2) Informational materials regarding potential hazards should be developed for staff and participants.
3) Corporate sponsors are required to test donor animals and tissues for infectious agents (see pages 6-8, 16, 19-29 of guidance document) and to maintain archived blood and tissue samples. They must also report adverse events in clinical trials, and insure that appropriate and up-to-date microbiologic assays are in place for known and potential human pathogens. The sponsor of each study must maintain these records for 50 years. Surveillance samples are required from subjects, source animals, and health care workers (see pages 16, 27, 29, 33 of guidance document).

4) Clinical centers performing XT trials should have the capability to culture and identify potential pathogens on site or through collaborators.

5) Most clinical trials to date have tested blood cells or serum samples to ascertain the presence of potential infection during XT trials. Given that pathogens, including most viruses, have preferred tropism for specific tissues (e.g., brain, lymphocytes, liver); it is likely that such testing is not adequate to detect subclinical infection. Thus, it is reasonable to test multiple tissues during the course of each study (e.g., biopsies, blood samples, autopsy samples) using the most sensitive assays available. The development of new assays will necessitate the re-testing of stored samples. The absence of appropriate assays will necessitate the utilization of resources to develop such assays. Thus, for example, if a study involves xenotransplantation of porcine tissues into the brain, it is reasonable to test any brain tissue samples for PERV DNA and RNA. Other clinical compartments available for testing (i.e., blood) can be used for serial testing of cells and sera for PERV DNA and RNA. The risk for infection may be increased in some trials by the need for immune suppression to prevent graft rejection. COMS considers the investigator responsible for all aspects of each XT trial. These responsibilities include, but are not limited to:

a) Data regarding microbiologic risks are to be provided by corporate sponsors to the investigator. The investigator will provide such information to both COMS and the relevant IRB as part of, or as an amendment to, each XT proposal.

b) The FDA requires that each XT trial includes appropriate infectious disease and epidemiological support to assure appropriate protection of subjects and their contacts throughout the trial and to assist in the evaluation of infectious syndromes if such occur.
c) Annual reports of XT trials must be provided to COMS for review as a condition of trial continuation. As studies progress, it is reasonable to ask investigators to obtain and provide data obtained from earlier clinical trial subjects and from other participating centers. Corporate sponsors and/or investigators must assure that the maximum possible effort (up-to-date assay systems) has been made to identify any infection due to known or unknown infectious agents.

d) The potential benefit to the patient and/or the scientific merit of the proposed trial must outweigh the perceived risks to the subject associated with XT procedures.

e) Administrative review or approval of XT trials will not be available.

f) Significant adverse events will be reported to the IRB and to COMS even if not considered related to the exposure to xenogenic tissues. SAE’s from other centers performing clinical trial must also be reported to COMS in a timely fashion. Any adverse event which may have implications for microbiologic safety must also be reported to COMS. SAEs that do not require reporting are those that are considered un-related to the study drug or fall out of reporting requirements of the institutional review board(s) that are overseeing the study.

g) Life-long monitoring of all subjects is required. Assurance of such monitoring is the responsibility of the investigator and trial sponsors. Subjects unable to comply with this or other aspects of the trial should not be included as trial subjects.

h) Investigators should consider that review of complex XT trials is a time consuming process. The timely submission of materials will expedite the review process.

i) Protocol Closures: Clinical trials that are being closed require notification from the PI to COMS. All filings shall be distributed through the Biosafety officer at each respective institution. A clinical trial is considered completed by COMS under the following circumstances:

j) Only data analysis is being conducted

k) Study follow up is only to confirm long-term survival

l) Patients are no longer receiving study drug or follow up and

m) There is no further study enrollment of new patients

n) Research samples from the patients are no longer being analyzed by laboratories

IV. Policy Authority
The Committee on Microbiological Safety shall enforce this policy.

V. Related Policies

VI. References
NIH Guidelines Appendix M
COMS Training Policy

I. Purpose
The purpose of this policy is to provide the requirements for training to all personnel involved with a COMS registered protocol.

II. Applicability and Minimum Guidelines
A. All personnel (PI and staff) working on COMS-registered research must meet all institution-mandated training requirements.
B. All PIs registered with COMS must complete NIH Recombinant DNA Guidelines training prior to initiation of rDNA work and not less frequently than once every three years thereafter.
C. An initial awareness-level training on the NIH Recombinant DNA guidelines must be provided to PIs that do not work with rDNA.
D. All laboratory staff working on COMS-registered research must be provided registration and agent-specific biosafety training. This training may be performed by the PI or by a knowledgeable designee. The training must be provided prior to initiation of work, when novel biohazards are added to the work, and as per institutional requirements, but not less frequently than once every three years.

III. Definitions

IV. Record Keeping Requirement:
Each institution or their designee maintains documentation of training for laboratories under COMS purview.

V. Implementation procedures
A. Monitoring Compliance and Sanctions for Non-compliance:
   1) Each institution shall verify at the time of laboratory inspections
   2) At the time of COMS registration renewal the PI or his designee will verify the PI and their laboratory members have taken the required biosafety training.
   3) Untrained individuals will be prohibited from working on the registered biological research.
   4) COMS registration will be suspended if training non-compliance is not corrected.

B. COMS Responsibilities:
1) Establishes minimum guidelines for required training at participating institutions
2) Ensures appropriate training for the Committee Chair and members
3) Provides materials/resources for institutions to meet training requirement
4) Notifies Institutional BSOs about new regulations related to training, changes in COMS processes, training modifications
5) Provides training to IACUC/IRB/Grants management personnel on COMS procedures

C. Institutional Responsibilities:
   1) Delivers and documents, through methods determined by the institution, annual biosafety training.
   2) Distributes or makes available training resources/references such as Biosafety Manual, Lab Inspection Checklist, autoclave validation process, spill kits, etc.
   3) Provides resources to laboratories to enable them to perform laboratory and registration-specific biosafety training upon request.

VI. Policy Authority
    The Committee on Microbiological Safety shall enforce this policy.

VII. Related Policies

VIII. References
COMS Inspection Policy

I. Purpose
The purpose of this policy is to standardize the information provided by all BSOs to the Office of Biological Safety and COMS committee members on the laboratory inspection data.

II. Applicability
All laboratories that have a registered COMS application must have a current laboratory inspection date and be in compliance with findings that resulted from their laboratory inspection.

III. Definitions

IV. Implementation procedures

A. Oversight
Section IV-B-2-b-(1) of the National Institutes of Health (NIH) Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines) states that the Institutional Biosafety Committee (known here as the Committee on Microbiological Safety (COMS)) is responsible for the assessment of the facilities, procedures, practices, and training and expertise of personnel involved in recombinant (DNA) research. In order to fulfill these COMS requires:

1) Institutional Biosafety Officers (BSOs) submit on an annual basis a Standard Operating Procedure (SOP) including, but not limited to, inspection checklists, methods to address noncompliance,
2) BSOs submit on a monthly basis, completed inspection dates
3) BSOs should submit any significant or chronic biological safety issues that were identified.

B. Review:
Documents and inspection results submitted by BSOs to fulfill the requirements above will be reviewed by the Associate Director of Microbiological Safety. If necessary, the
Associate Director may raise specific documents or inspection results to the attention of COMS Chair and/or COMS.

C. Frequency
The NIH Guidelines require that BSOs (or alternate personnel trained by the BSOs) conduct periodic laboratory inspections to ensure that laboratory standards are rigorously followed.

COMS requires that inspections of all laboratories with active COMS registrations be conducted once per calendar year for Biosafety Level 2 (BL2) and Biosafety Level 3 (BL3).

COMS requires Biosafety Level 1 (BL1) laboratories be inspected at least once per every other calendar year.

D. Reporting
Significant and/or chronic problems, biosafety violations, violations of the NIH Guidelines, or research-related accidents identified during laboratory inspections or otherwise must be reported to COMS as soon as the BSO is aware. The COMS Incident Reporting Policy should also be reviewed to determine if reporting to governmental agencies is required.

E. Policy Authority
The Committee on Microbiological Safety shall enforce this policy.

F. Related Policies
   COMS Incident Reporting Policy

G. References
POLICY ON SUITABLE METHODS OF LIQUID DECONTAMINATION AND DISPOSAL

I. Purpose
To satisfy a Massachusetts regulation on the proper disposal of biologically contaminated liquid waste.

II. Applicability
In July 2008 the Massachusetts Department of Public Health required certain changes in the disposal of biological waste. One aspect of the new regulations was the requirement that the local Institutional Biosafety Committee approve the method of liquid effluent disinfection. This policy applies to all institutions that generate biological waste and use the Committee on Microbiological Safety (COMS) as their IBC of record.

III. Definitions
Medical or Biological Waste:
Waste that because of its characteristics may pose a potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

The following types of liquid biological waste are identified and defined as medical or biological waste, and have been adapted from the requirements of 105 CMR 480.000:

- Cultures and stocks of infectious agents
- Recombinant DNA
- blood and blood products
- non-human primate blood and blood products
- any other human or non-human primate body fluids known or suspected to contain infectious materials.

IV. Implementation Procedures
A. General Information
1) The use of 10% bleach (final concentration) or autoclaving are approved disinfectants for potentially contaminated effluents.
2) 10% bleach deteriorates with time and should be prepared frequently — at least weekly. Effluents should be treated with bleach for at least 20
minutes. The autoclave should be tested using spore strips approved by the Biosafety Officer.

3) An on-site treatment log is not required for BL1 and BL2 liquid waste for drain disposal given that the IBC approves the disinfection SOP and an EPA approved disinfectant is used appropriate for the agents in use

4) Alternative methods for disinfection of liquid waste for drain disposal should be approved by COMS prior to instituting the method in the laboratory.

B. Procedure

Two Options are provided for Disinfection of Liquid Waste As Follows:

Option 1: Bleach disinfection

1) Effectiveness and EPA Approval:

Bleach, a sodium hypochlorite solution (NaOCl), is a broad-spectrum disinfectant that is an effective disinfectant for enveloped viruses (e.g. HIV, HBV, HSV), vegetative bacteria (e.g. Pseudomonas, Staphylococcus, and Salmonella), fungi (e.g. Candida), mycobacterium (e.g. M. tuberculosis and M. bovis), and non-enveloped viruses (e.g. Adenovirus and Parvovirus). E.g. Austin A1 mercury-free bleach and Clorox bleach EPA registration numbers are 1672-20004 and 5813-50, respectively.

2) Recommended Personal Protective Equipment:
   a. Lab coat
   b. Latex or nitrile gloves
   c. Safety glasses

3) Concentration:

The appropriate concentration of sodium hypochlorite for disinfecting liquid BL1 and BL2 waste, e.g. supernatants from cell culture, is 5000 ppm, approximately 0.5%. Household bleach is 5.2 - 6.1 % sodium hypochlorite, therefore a 1:10 (v/v) dilution of bleach to liquid biological waste is appropriate.

4) Procedure:

   All liquid waste should be collected in a final concentration of 10% bleach with a contact time of at least 20 minutes prior to disposal.

   After 20 minutes of contact, disinfected liquid waste is disposed of per institutional policy.
5) Stability and Storage:

Bleach should be stored according to manufacturer instructions, to maintain stability, typically between 50 and 70°F. According to Clorox, undiluted household bleach has a shelf life of six months to one year from the date of manufacture, after which bleach degrades at a rate of 20% each year until totally degraded to salt and water. Some manufacturer-prepared 1:10 bleach solutions, e.g. Bleach-Rite, contain a stabilizer that increases the shelf life to approximately 18 months.

6) Documentation:

An on-site treatment log and validation is not required for chemical disinfection of BL1 and BL2 liquid waste for drain disposal.

Option 2: Autoclave
1) Effectiveness:
Autoclaving is an effective means of sterilizing BL1 and BL2 liquid waste. Sterilization refers to the complete killing of all living organisms, including spores. The autoclave is validated on a quarterly interval for effectiveness by using a biological indicator, e.g. Geobacillus sterothermophilus spores.

2) Recommended Personal Protective Equipment:
- Lab coat
- Latex or nitrile gloves
- Heat resistant gloves
- Safety glasses

3) Procedure:
- Collect BL1 and BL2 liquid waste in autoclavable, leak proof containers that are never more than ¾ full.
- Place containers in an autoclavable tray in the autoclave. LOOSEN each container top and place indicator tape on each top.
- Adequate cycle time varies depending on load, type of autoclave, and secondary containment. Every autoclave facility needs to determine optimal conditions (Time, Temperature, and Pressure) for their autoclave for waste. Typical cycle times for sterilizing liquid waste range from 45 to 90 minutes at 250°F (121°C) and 15 psi.
- Pour sterilized liquid waste down the sink and flush the drain with water.
4) Documentation: An on-site treatment log and validation is not required for chemical disinfection of BL1 and BL2 liquid waste for drain disposal.

5) Laboratory/Containment

V. Policy Authority
The Office of Biological Safety of the Harvard Medical School is responsible for supporting the Committee on Microbiological Safety. This includes preparation and revising of the COMS Policy Manual for committee review and approval. The Committee on Microbiological Safety (COMS) authorizes this policy.

VI. Related Policies
Suitable Methods of Solid Biowaste Decontamination and Disposal
Suitable Methods for Use of Sharps

VII. References
POLICY ON USE OF SHARPS

I. Purpose
   To establish a policy on the safe use of sharps.

II. Applicability
   This policy applies to all institutions that use sharps and use the Committee on
   Microbiological Safety (COMS) as their IBC of record.

III. Definitions
   A) Sharps:
   B) Discarded medical and research items that may cause puncture or cuts, including,
      but not limited to, all needles, syringes, lancets, pen needles, glass pasteur
      pipettes, broken
   C) glassware, glass slides, cover slips, scalpels and razor blades, suture needles,
      dental wires, and disposable razors used in connection with a medical or research
      procedure.

IV. Implementation Procedures for Safe Sharps Use
   A) Procedure
      1) Eliminate the use of devices sharp enough to puncture your skin (including glass)
         whenever possible
      2) Use a sharp with an engineered safety feature when such a device is available and
         feasible for your procedure.
      3) Get trained in proper techniques before using sharp devices in conjunction with
         biohazardous materials.
      4) Use scalpels in the appropriate and safe manner.
      5) Do not leave sharp devices out in the environment any longer than necessary.
      6) Eliminate recapping needles.
      7) Do not put excessive force on a sharps device
      8) Use an appropriate sharps container for disposal of sharps waste.
      9) Do not fill sharps containers more than 2/3
     10) Wear appropriate PPE in accordance with institutional policy
     11) Storage: Sharps must be safely stored in the laboratory when not in use. Sharps
         that are used must be stored for Biowaste Sharps disposal in a rigid sharps
         container. If a sharp must be re-used, it should be placed in a rigid container with
         a lid.
B) Policy Authority

The Office of Biological Safety of the Harvard Medical School is responsible for supporting the Committee on Microbiological Safety. This includes preparation and revising of the COMS Policy Manual for committee review and approval. The Committee on Microbiological Safety (COMS) authorizes this policy.

C) Related Policies

1) Suitable Methods of Liquid Biowaste Decontamination and Disposal
2) Suitable Methods for Solid Biowaste Decontamination and Disposal

D) References

105 CMR 480.000 Minimum Requirements for the Management of Medical or Biological Waste (State Sanitary Code Chapter VIII), effective July 11, 2008.
COMS Policy on Recommended Containment Levels for Adenoviral Vectors in Laboratory Rats, Laboratory Mice and Laboratory Rabbits

I. Purpose: Provide containment requirements for use of adenoviral vectors in Laboratory Rats, Laboratory Mice and Laboratory Rabbits.

II. Applicability:

All COMS projects involving the use of adenoviral vectors in Laboratory Rats, Laboratory Mice and Laboratory Rabbits must comply with the requirements of this policy.

III. Definitions:

A) BL2-N(72hr):
Animals are housed in BL2-N containment for the first 72 hours following inoculation with viral vector according to the guidelines of the specific institution. Animal care during this time period is handled by either the laboratory personnel (best practice) or animal care workers, depending on the institution. Waste materials such as bedding, feces and urine should be disposed as of biohazardous waste. After a minimum of 72 hours, animals must be placed in a clean cage before animals can be housed at BL1-N for the remainder of experiment. Please consult with your Biosafety Officer, IACUC and/or Animal Facility Manager on approved procedures at your Institutions animal facility.

IV. Implementation procedures

A. Inoculation
Inoculations of adenoviral vectors into animals are to be performed within a biological safety cabinet under biosafety level 2 (BL2) conditions. Safer, engineered needles or needle less systems should be used, when possible. Inoculations should be conducted by trained personnel only. The site of inoculation should be thoroughly cleansed to prevent contamination of bedding materials.

B. Housing
1. The level of housing containment for animals inoculated with viral vectors that can infect human cells is dependent on the characteristics of the viral vector, the animal host, inoculation method, and the transgene.

For most experiments where common, well described replication incompetent adenoviral vectors are inoculated into rodents, the required housing containment is dependent on the expressed transgene (see table below).

2. A list of common, well described adenoviral vector systems is being developed and will be added to this policy when it becomes available. Vectors not on this list may be approved with at a higher containment level.

<table>
<thead>
<tr>
<th>Transgene Type</th>
<th>Housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporter genes (e.g., green fluorescent protein, LacZ)</td>
<td>BL1-N</td>
</tr>
<tr>
<td>Genes with biological activity</td>
<td>BL2-N for first 72 hours post inoculation followed by BL1-N housing (denoted as BL2-N(72hr))</td>
</tr>
<tr>
<td>Oncogene or toxin gene (or transgenes with high oncogenic or toxic potential)</td>
<td>BL2-N housing for the life of the animal</td>
</tr>
</tbody>
</table>

C. BL2-N(72hr):
   1. Definition - Animals are housed in BL2-N containment for the first 72 hours following inoculation with viral vector. Laboratory personnel are responsible for animal care during this time period. Waste materials such as bedding, feces and urine should be disposed as of biohazardous waste. After 72 hours, lab personnel will place animals in a clean cage and animals can be housed at BL1-N for remainder of experiment. Please consult with your IACUC and/or Animal Facility Manager on approved procedures at your Institution’s animal facility.
   2. Rationale – Studies suggest that the potential for shedding of replication competent virus (RCV) is low but not unfeasible.\textsuperscript{1,11} Therefore, a reduction in containment to BL1-N after 72 hours, reduces the risk of exposure to shed virus and allows for a sensible safety factor.

D. Exceptions:
   1. Animals engrafted or injected with human cells or animal hosts that are permissive for adenovirus replication (e.g., cotton rat, hamster), may be approved at a higher containment level.
2. Depending on the specific project attributes, COMS may require BL2-N housing for the life of the animal regardless of the expressed transgene.
3. This policy is subject to change as new information on viral shedding becomes available.
4. This policy is specific to lab rats, lab mice, not other rodent species. Other animal species may be examined on a case by case basis by COMS.

V. Policy Authority:
The Office of Biological Safety (OBS) of the Harvard Medical School is responsible for supporting the Committee on Microbiological Safety. This includes preparation and revising of the COMS Policy Manual for committee review. The Committee on Microbiological Safety (COMS) authorizes this policy.

VI. Related Policies

VII. References
Policy on Recommended Containment Levels for use of Retroviral Vectors in Laboratory Rats, Laboratory Mice and Laboratory Rabbits

I. Purpose:

Provide containment requirements for use of retroviral vectors in Laboratory Rats, Laboratory Mice and Laboratory Rabbits.

II. Applicability:

All COMS projects involving the use of retroviral vectors in Laboratory Rats, Laboratory Mice and Laboratory Rabbits must comply with the requirements of this policy.

III. Definitions:

A) BL2-N(72hr):
Animals are housed in BL2-N containment for the first 72 hours following inoculation with viral vector according to the guidelines of the specific institution. Animal care during this time period is handled by either the laboratory personnel (best practice) or animal care workers, depending on the institution. Waste materials such as bedding, feces and urine should be disposed as of biohazardous waste. After a minimum of 72 hours, animals must be placed in a clean cage before animals can be housed at BL1-N for the remainder of experiment. Please consult with your Biosafety Officer, IACUC and/or Animal Facility Manager on approved procedures at your Institutions animal facility.

IV. Implementation procedures

A. Inoculation

1. Inoculations of retroviral vectors that can infect human cells (e.g., vectors pseudotyped with VSV-G Env protein) into animals are to be performed within a biological safety cabinet under biosafety level 2 (BL2) conditions.

2. Inoculations with ecotropic viral vectors (i.e., vectors that cannot infect human cells) can be performed under biosafety level 1 (BL1) conditions and inoculated animals housed in animal biosafety level 1 (BL1-N) conditions.
3. Safer, engineered needles or needle less systems should be used, when possible. Inoculations should be conducted by trained personnel only.
4. The site of inoculation should be thoroughly cleansed to prevent contamination of bedding materials.

B. Housing
1. The level of housing containment for animals inoculated with viral vectors that can infect human cells is dependent on the characteristics of the viral vector, the animal host, inoculation method, and the transgene.
2. For most experiments where common, replication incompetent second or third generation retroviral vectors (and packaging systems) are inoculated into animals, the required housing containment is dependent on the expressed transgene (see table below).
3. A partial list of common, well described viral vector systems are located in Appendix F and common packaging systems in Appendix G. Vectors not on this list may be approved with at a higher containment level.

<table>
<thead>
<tr>
<th>Transgene Type</th>
<th>Housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporter genes (e.g., green fluorescent protein)</td>
<td>BL1-N</td>
</tr>
<tr>
<td>Genes with biological activity</td>
<td>BL2-N for first 72 hours post inoculation followed by BL1-N housing (denoted as BL2-N(72hr))</td>
</tr>
<tr>
<td>Oncogene or toxin gene (or transgenes with high oncogenic or toxic potential)</td>
<td>BL2-N housing for the life of the animal</td>
</tr>
</tbody>
</table>

C. BL2-N(72hr):
1. Rationale – Studies suggest that the potential for shedding of replication competent virus (RCV) is low but not unfeasible in non-permissive hosts (even if RCV were present in the original vector inoculum)\(iii\). Therefore, based on guidance from the NIH\(iv\), a reduction in containment to BL1-N after 72 hours reduces the risk of exposure to shed virus and allows for a sensible safety factor.
D. Exceptions:

1. In light of their potential to support replication of infectious HIV-1, animals engrafted or injected with human cells or animal hosts that are permissive for retrovirus replication (e.g., SCID mice with humanized immune systems), may be approved at a higher containment level.

2. Depending on the specific project attributes, COMS may require BL2-N housing for the life of the animal regardless of the expressed transgene.

3. This policy is subject to change as new information on viral shedding becomes available.

4. This policy is specific to lab rats, lab mice, not other rodent species. Other animal species may be examined on a case by case basis by COMS.

V. Policy Authority:

The Office of Biological Safety (OBS) of the Harvard Medical School is responsible for supporting the Committee on Microbiological Safety. This includes preparation and revising of the COMS Policy Manual for committee review. The Committee on Microbiological Safety (COMS) authorizes this policy.

VI. Related Policies

VII. References


Appendix A

List of Harvard-affiliated medical and research institutions for which COMS serves as the Institutional Biosafety Committee and the Biosafety Officer for that institution.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Biosafety Officer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beth Israel Deaconess Medical Center, Boston, MA</td>
<td>Suanne Simon</td>
</tr>
<tr>
<td>Harvard Faculty of Arts &amp; Sciences, Cambridge, MA</td>
<td>Sid Paula</td>
</tr>
<tr>
<td>Harvard Medical School (HMS), Boston, MA</td>
<td>Kathy Gilbert &amp; Christine Tafoya</td>
</tr>
<tr>
<td>Harvard Institutes of Medicine, Boston, MA</td>
<td>Nanette Moss</td>
</tr>
<tr>
<td>Harvard School of Public Health, Boston, MA</td>
<td>Kathy Gilbert &amp; Christine Tafoya</td>
</tr>
<tr>
<td>Harvard Dental School, Boston, MA</td>
<td>Kathy Gilbert &amp; Christine Tafoya</td>
</tr>
<tr>
<td>Joslin Diabetes Center, Boston, MA</td>
<td>Maureen Dupuis</td>
</tr>
<tr>
<td>Massachusetts Eye and Ear Infirmary, Boston, MA</td>
<td>Kathleen Joseph</td>
</tr>
<tr>
<td>New Research Building, HMS, Boston, MA</td>
<td>Nanette Moss</td>
</tr>
</tbody>
</table>
### Appendix B  Risk Group Classifications WHO and NIH rDNA Guidelines

<table>
<thead>
<tr>
<th>RG</th>
<th>WHO</th>
<th>NIH rDNA Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>RG1</td>
<td>A microorganism that is unlikely to cause human disease or animal disease</td>
<td>Agents not associated with disease in healthy adult humans. Includes a list of animal viral etiologic agents in common use.</td>
</tr>
<tr>
<td>RG2</td>
<td>A pathogen that can cause human or animal disease but is unlikely to be a serious hazard to laboratory workers, the community, livestock or the environment. Laboratory exposures may cause serious infection, but effective treatment and preventative measures are available and the risk of spread of infection is limited.</td>
<td>Agents that are associated with human disease which is rarely serious and for which preventive or therapeutic interventions are often available.</td>
</tr>
<tr>
<td>RG3</td>
<td><strong>A pathogen that usually causes serious human or animal disease but does not ordinarily spread from one infected individual to another. Effective treatment and preventive measures are available.</strong></td>
<td></td>
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<tr>
<td>-----</td>
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</tr>
<tr>
<td></td>
<td><strong>Agents that are associated with serious or lethal human disease for which preventive or therapeutic interventions may be available (high individual risk but low community risk).</strong></td>
<td></td>
</tr>
<tr>
<td>RG4</td>
<td><strong>A pathogen that usually causes serious human or animal disease and that can be readily transmitted from one individual to another, directly or indirectly. Effective treatment and preventive measures are not usually available.</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Agents that are likely to cause serious or lethal human disease for which preventive or therapeutic interventions are not usually available</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Appendix C  BMBL, 5th Edition, Biological Safety Levels**

<table>
<thead>
<tr>
<th>BL1</th>
<th>Suitable for work involving well-characterized agents not known to consistently cause disease in immuno-competent adult humans, and present minimal potential hazard to laboratory personnel and the environment. BSL-1 laboratories are not necessarily separated from the general traffic patterns in the building.</th>
</tr>
</thead>
</table>
| BL2  | Suitable for work involving agents that pose moderate hazards to personnel and the environment.  
1) laboratory personnel have specific training in handling pathogenic agents 2) access to the laboratory is restricted when work is being conducted; and 3) all procedures in which infectious aerosols or splashes may be created are conducted in BSCs or other physical containment equipment. |
<table>
<thead>
<tr>
<th>BL3</th>
<th>Suitable for work with indigenous or exotic agents that may cause serious or potentially lethal disease through inhalation route exposure. Manipulation of infectious materials must be conducted within BSCs, other physical containment devices, or by personnel wearing appropriate personal protective equipment. Physical separation from access corridors, self-closing/double-door access, exhaust air not recirculated, negative airflow, controlled access</th>
</tr>
</thead>
<tbody>
<tr>
<td>BL4</td>
<td>Suitable for work with dangerous and exotic agents that pose a high individual risk of life-threatening disease, aerosol transmission, or related agent with unknown risk of transmission.</td>
</tr>
</tbody>
</table>
## Appendix D: Regulatory Agency Reporting Procedure

<table>
<thead>
<tr>
<th>Regulatory Agency</th>
<th>Jurisdiction</th>
<th>Reporting Requirements / Procedure</th>
<th>Timing to Report</th>
</tr>
</thead>
</table>
| NIH OBA           | All institutions receiving NIH funding for rDNA | Telephone or Email Correspondence to Dr. Kathryn Harris  

*In some cases, it may be appropriate to contact the NIH/OBA by telephone or email to determine if NIH/OBA considers the incident to be reportable.* | Within 30 days.  
Note: certain types of incidents require immediate reporting. Consult regulation |
Boston Public Health Commission

City of Boston only

1) rDNA BL3 and BL4 Labs

1) Telephone or Email Correspondence

2) For laboratory’s with BPHC BL3 Permits:
   a. Employees exhibiting symptoms or may have been exposed to agents in use in the BPHC permitted BL3 laboratory
   b. Employees absent for two or more consecutive working days, where Institutional Occupational Health personnel have reasonable suspicion that the illness may be related to an exposure to agent in use in the BPHC permitted BL3 laboratory
   c. Failures, malfunctions

1) Within thirty (30) days an institution shall report any significant problems with or violations of the Guidelines and any significant RDNA related accidents or illnesses to the Executive Director and the Boston RDNA Advisory Committee. Any such problems, accidents, or illnesses which have a potential impact on the public health and safety shall be reported immediately.

2) Immediate reporting
<table>
<thead>
<tr>
<th>Cambridge Public Health Department</th>
<th>1) All institutions receiving NIH funding for rDNA: 2) BL3 Labs</th>
<th>1) Telephone or Email Correspondence to Director of Environmental Health</th>
<th>2) Telephone or Email Correspondence to Director of Environmental Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA DPH</td>
<td>State of MA Biological Waste (see regulation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDC/APHIS Select Agent Program</td>
<td>Select Agents (see regulation for complete list)</td>
<td>Select Agent Responsible Official must report</td>
<td>RO must contact APHIS or CDC immediately upon discovery of a theft, loss, or a release (occupational exposure or release of an agent or toxin outside of the primary barriers of the biocontainment area) of a Select Agent and Toxin not authorized under a federal act.</td>
</tr>
</tbody>
</table>
Appendix E: Regulatory Agency Contact List for Reporting of incidents:

<table>
<thead>
<tr>
<th>Agency Contact</th>
<th>Regulation</th>
<th>Website/Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Kathryn Harris</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Institutes of Health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of Biotechnology Activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6705 Rockledge Dr., Suite 750</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bethesda, MD 20892-7985</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fax: 301-496-9839</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email: <a href="mailto:HarrisKath@od.nih.gov">HarrisKath@od.nih.gov</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Express mail (FedEx, UPS, etc.):

<table>
<thead>
<tr>
<th>Agency Contact</th>
<th>Regulation</th>
<th>Website/Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Kathryn Harris</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Institutes of Health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of Biotechnology Activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6705 Rockledge Dr., Suite 750</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bethesda, MD 20817-1814</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fax: 301-496-9839</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email: <a href="mailto:HarrisKath@od.nih.gov">HarrisKath@od.nih.gov</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td>Regulations</td>
<td>Reporting Form</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Boston Public Health Commission, Communicable Disease Control Division</td>
<td>1) BPHC Recombinant DNA Technology: Use Regulations</td>
<td></td>
</tr>
<tr>
<td>1010 Massachusetts Avenue, Boston, MA 02118</td>
<td>2) BPHC Disease Surveillance and Reporting Regulation</td>
<td>Regulations: <a href="http://www.bphc.org/programs/cib/environmentalhealth/biologicalsafety/Pages/Home.aspx">http://www.bphc.org/programs/cib/environmentalhealth/biologicalsafety/Pages/Home.aspx</a></td>
</tr>
<tr>
<td>Phone: 617-534-5611</td>
<td>3) BPHC Biological Laboratory Regulation</td>
<td></td>
</tr>
<tr>
<td>Fax 617-534-5905</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sam Lipson. Director of Environmental Health, Cambridge Public Health Department</td>
<td>Recombinant DNA Ordinance</td>
<td>No Specific Reporting Template.</td>
</tr>
<tr>
<td>119 Windsor Street, Ground Level Cambridge, MA 02139</td>
<td>Cambridge Biosafety Regulation</td>
<td>Regulations: <a href="http://www.cambridgepublichealth.org/services/regulatory-activities/biosafety/">http://www.cambridgepublichealth.org/services/regulatory-activities/biosafety/</a></td>
</tr>
<tr>
<td>Phone 617-665-3838</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fax 617-665-3888</td>
<td></td>
<td></td>
</tr>
<tr>
<td><a href="mailto:slipson@challiance.org">slipson@challiance.org</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APHIS Select Agent Program</td>
<td>42 CFR 73.0 Select Agent Rule</td>
<td>Reporting Form: Form 3 Report of Theft Loss or Release Available at: <a href="http://www.selectagents.gov/TLRForm.html">http://www.selectagents.gov/TLRForm.html</a></td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>4700 River Road Unit 2, Mailstop 22, Cubicle 1A07 Riverdale, MD 20737</td>
<td></td>
<td>Regulations: <a href="http://www.selectagents.gov/Regulations.html">http://www.selectagents.gov/Regulations.html</a></td>
</tr>
<tr>
<td>Fax: 301-734-3652</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email: <a href="mailto:Agricultural.Select.Agent.Program@aphis.usda.gov">Agricultural.Select.Agent.Program@aphis.usda.gov</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CDC Select Agent Program</th>
<th>42 CFR 73.0 Select Agent Rule</th>
<th>Form 3 Report of Theft Loss or Release Available at: <a href="http://www.selectagents.gov/TLRForm.html">http://www.selectagents.gov/TLRForm.html</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>1600 Clifton Road NE, Mailstop A-46, Atlanta, GA 30333</td>
<td></td>
<td>Regulations: <a href="http://www.selectagents.gov/Regulations.html">http://www.selectagents.gov/Regulations.html</a></td>
</tr>
<tr>
<td>Fax 404-718-2096</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email: <a href="mailto:lrsat@cdc.gov">lrsat@cdc.gov</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Appendix F: Top 10 Most Commonly Used Retroviral Vectors in Animals

<table>
<thead>
<tr>
<th>Vector</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>pLenti (various versions)</td>
<td>Invitrogen</td>
</tr>
<tr>
<td>pRRL</td>
<td>Salk Institute</td>
</tr>
<tr>
<td>MSCV</td>
<td>Many</td>
</tr>
<tr>
<td>pLKO</td>
<td>Open BioSystems, AddGene, Others</td>
</tr>
<tr>
<td>pBabe</td>
<td>Many</td>
</tr>
<tr>
<td>MLV</td>
<td>Many</td>
</tr>
<tr>
<td>pSICO</td>
<td>AddGene, others</td>
</tr>
<tr>
<td>Lenti-Lox</td>
<td>Many</td>
</tr>
<tr>
<td>pSMPUW</td>
<td>Cell Biolabs</td>
</tr>
<tr>
<td>MoMuLV</td>
<td>Many</td>
</tr>
<tr>
<td>pHAGE</td>
<td>R. Mulligan</td>
</tr>
<tr>
<td>pMMP</td>
<td>R. Mulligan</td>
</tr>
</tbody>
</table>
## Appendix G: Common Packaging System

1. Invitrogen ViraPower -

2. Phoenix Amphi Packaging System (Obigen) -

3. Trans-Lentiviral™ Packaging System (Open Biosystems) -

4. pPack Packaging Systems (System Biosciences) -

5. Lenti-X Packaging Systems (Clontech) -

6. Packaging Systems from HGTI

7. pCMV-R8.74 and pMD2G from Didier Trono - [http://tronolab.epfl.ch/page71945.html](http://tronolab.epfl.ch/page71945.html)

8. psPAX2 – Originally from Trono (deposited at AddGene), second gen packaging vector - [http://www.lablife.org/p?a=vdb_view&id=g2%2e7Qg9zRofxbsyPKiTgbD%2eFpe1fTQ%2d](http://www.lablife.org/p?a=vdb_view&id=g2%2e7Qg9zRofxbsyPKiTgbD%2eFpe1fTQ%2d)