

EHS Use Only  
Protocol#:

Send original to: Yale Environmental Health and Safety  
Occupational Health and Safety Section 135  
College Street, Suite 100  
New Haven, CT 06510  
Phone 785-3550 fax: 785-7588

Yale University Biological Safety Committee

**Registration of Experiments Involving Recombinant or Synthetic Nucleic Acid Molecules**

Principal Investigator: \_\_\_\_\_

Faculty Rank or Research Appointment: \_\_\_\_\_

(Faculty Rank must equal Research Scientist or Higher)

Department of Academic Appointment: \_\_\_\_\_

Institute/Department Section: \_\_\_\_\_ Telephone #: \_\_\_\_\_ Fax #: \_\_\_\_\_

Lab Manager/Supervisor: \_\_\_\_\_ Telephone #: \_\_\_\_\_

Locations (Buildings, Room #s): \_\_\_\_\_

Provide ALL locations where research with recombinant or synthetic nucleic acids will occur, include animal facilities and core research facilities (e.g. Cell Sorting, Electron Microscope, Confocal Microscope, or Genomics Core Laboratories):

Anticipated Starting Date: \_\_\_\_\_

(The earliest start date for non-exempt research = next Committee Meeting date or 3<sup>rd</sup> Thursday of current month)

Short Title of Proposal: \_\_\_\_\_

(Please note that the title of your protocol and brief description may be subject to public review. Thus, it is advisable that the title and description use terminology understandable to the general public and avoid language or descriptions that could be misinterpreted by the general public)

Brief summary stated in non-technical language: (You may attach a summary of your proposed research from a grant application or other document)

I attest that the information in the attached Registration is accurate and complete. I am familiar with and agree to comply with the current edition of the NIH Guidelines for Research Involving Recombinant and Synthetic Nucleic Acid Molecules (NIH Guidelines) and accept the Principal Investigator responsibilities listed in the NIH Guidelines Section IV-B-7, as well as any modifications of these guidelines subsequently issued by the Federal Government or Yale University.

As the Principal Investigator, I agree to accept responsibility for training all laboratory workers involved in the project. All research personnel will be familiar with and understand the potential biohazards and relevant biosafety practices, techniques and emergency procedures.

Written reports will be submitted to the Biological Safety Officer, the Biological Safety Committee, and the Office of Biotechnology Activities at NIH (if applicable) concerning: any research related accident, exposure incident or release of recombinant or synthetic nucleic acid molecules or materials containing them to the environment; problems pertaining to the implementation of biological and physical containment procedures; or violations of the NIH Guidelines.

I will not conduct the work described in the attached registration until it has been filed with, and if necessary, approved by the Biological Safety Committee.

Principal Investigator \_\_\_\_\_  
Signature

Date \_\_\_\_\_

Additional Investigator \_\_\_\_\_  
Signature

Date \_\_\_\_\_

Reviewed and Accepted \_\_\_\_\_  
Institutional Biological Safety Committee

Date \_\_\_\_\_

**Principal Investigator Protocol Safety Assurance Statements:**

<input type="checkbox"/> Yes <input type="checkbox"/> No	My laboratory has all relevant and required safety equipment for the safe conduct of the research described in this application
<input type="checkbox"/> Yes <input type="checkbox"/> No	Personal protective equipment has been provided free of charge to those working on this project in the appropriate sizes
<input type="checkbox"/> Yes <input type="checkbox"/> No	I will supervise lab staff to ensure that the required biocontainment work practices and techniques are employed. I will correct any work practices and conditions that will result in the release of recombinant DNA materials.
<input type="checkbox"/> Yes <input type="checkbox"/> No	All personnel assigned to this project have completed all applicable EHS laboratory safety training classes (i.e. Biosafety Part 1 and Part 2, Bloodborne Pathogens for lab personnel, Lab Chemical Safety)
<input type="checkbox"/> Yes <input type="checkbox"/> No	Emergency exposure and spill response procedures have been outlined and reviewed with the laboratory staff
<input type="checkbox"/> Yes <input type="checkbox"/> No	As the Principal Investigator, I have completed the Yale EHS online class entitled "PI Orientation to the Yale Biological Safety Manual" (and any other applicable training classes if I am participating in the conduct of laboratory research)
<input type="checkbox"/> Yes <input type="checkbox"/> No	My laboratory will follow the emergency response protocols as detailed in the Yale University Biosafety Manual
<input type="checkbox"/> Yes <input type="checkbox"/> No	All incidents and exposures involving recombinant or synthetic nucleic acid molecules will be promptly reported to Yale EHS for evaluation
<input type="checkbox"/> Yes <input type="checkbox"/> No	All non-exempt experiments involving the use of recombinant or synthetic nucleic acid molecules will not be initiated until approved by the Yale University Biological Safety Committee
<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Any specific medical surveillance requirements for this protocol (i.e. immunizations, serum storage) have been communicated to all personnel involved in this project.

**High Risk Recombinant or Synthetic Nucleic Acid Molecule Research Experiments**

<input type="checkbox"/> Yes <input type="checkbox"/> No	Does this rDNA protocol involve the transfer of recombinant or synthetic nucleic acid molecules to human subjects?
<input type="checkbox"/> Yes <input type="checkbox"/> No	Does the rDNA protocol involve the cloning of molecules toxic to vertebrates with an LD50 of < 100 ng/kg body weight?
<input type="checkbox"/> Yes <input type="checkbox"/> No	Does the rDNA protocol involve the deliberate transfer of a drug resistance trait to microorganisms that are not known to acquire it naturally if such acquisition could compromise the ability of the drug to control disease? <i>(Example: Placing a gene for Ampicillin resistance in E. coli K12 would not meet this criteria, but placing an gene for Ampicillin resistance in Listeria monoctyogenes would).</i>
<input type="checkbox"/> Yes <input type="checkbox"/> No	Does this experiment involve the use of a Select Agent?
<input type="checkbox"/> Yes <input type="checkbox"/> No	Does this experiment involve the use of greater than 10 Liters of culture?

Principal Investigator

Signature: \_\_\_\_\_

Date \_\_\_\_\_

## Dual Use Research

In reviewing registrations, the Yale IBC considers "dual use" potential, namely the potential for research projects with a beneficial purpose to provide knowledge, products or technologies that could be directly misapplied to pose a threat to public health and safety, agricultural crops and other plants, animals, the environment, or material. For a full discussion of this topic, consult Dual Use Research and the National Science Advisory Board <https://oir.nih.gov/sourcebook/ethical-conduct/special-research-considerations/dual-use-research>

Will you be conducting research that directly uses nonattenuated forms of one or more of the following agents?

Yes  No.

If yes, please check the agent involved:

- |  |   |
|--|---|
| <input type="checkbox"/> Avian influenza virus (highly pathogenic) | <input type="checkbox"/> Marburg virus                                    |
| <input type="checkbox"/> Bacillus anthracis                        | <input type="checkbox"/> Reconstructed 1918 influenza virus               |
| <input type="checkbox"/> Botulinum neurotoxin (in any quantity)    | <input type="checkbox"/> Rinderpest virus                                 |
| <input type="checkbox"/> Burkholderia mallei                       | <input type="checkbox"/> Toxin-producing strains of Clostridium botulinum |
| <input type="checkbox"/> Burkholderia pseudomallei                 | <input type="checkbox"/> Variola major virus                              |
| <input type="checkbox"/> Ebola virus                               | <input type="checkbox"/> Variola minor virus                              |
| <input type="checkbox"/> Foot-and-mouth disease virus              | <input type="checkbox"/> Yersinia pestis                                  |
| <input type="checkbox"/> Francisella tularensis                    |   |

Do any of your experiments fall into any of the following experimental categories?  Yes  No

If yes, please check all that apply:

- Enhances the harmful consequences of the agent or toxin;
- Disrupts immunity or the effectiveness of an immunization against the agent or toxin without clinical and/ or agricultural justification;
- Confers to the agent or toxin resistance to clinically and/or agriculturally useful prophylactic or therapeutic interventions against that agent or toxin or facilitates their ability to evade detection methodologies;
- Increases the stability, transmissibility, or the ability to disseminate the agent or toxin;
- Alters the host range or tropism of the agent or toxin;
- Enhances the susceptibility of a host population to the agent or toxin; and
- Generates or reconstitutes an eradicated or extinct listed agent or toxin.
- Provide other knowledge, products or technologies that could be directly misapplied to pose a threat to public health and safety, agricultural crops and other plants, animals, the environment, or material.

Comment on aspects of your research, if any, with potential for dual use:

## Registration of Research Experiments with Recombinant or Synthetic Nucleic Acid Molecules

### I. General Information

For all Recombinant or Synthetic Nucleic Acid Molecule Experiments Provide:	
Type and name of rDNA Vector (provide name and company or person providing it). Provide reference also if available.	
Vector Map (attach from website) <b>Also include all packaging vectors</b> that will be used with your expression vector.	
Percent of the pathogen genome present in the vector (kilobases of the parent pathogen in the vector <b>plus</b> packaging plasmids and/or packaging cells combined)	
Please indicate the tropism of your vector (i.e. pantropic, amphotropic, ecotropic, xenotropic)	
Has your vector been pseudotyped with the VSV-G gene or another gene that can extend the tropism of your vector?	
Please indicate the gene that extends tropism?	
Can your vector infect a human cell?	

### II. Specific Information:

Complete the applicable parts of Section II based on the answers to the following questions and then proceed to part D of Section II.

Will experiment be carried out in E. coli or other prokaryotic host? Yes No

If Yes, complete part A.

Will experiment be carried out in eukaryotic cells? Yes No

If Yes, complete part B.

Will whole plants or animals (any member of the kingdom Animalia) be used as hosts? Yes No

If Yes, complete part C.

A. *E. coli* or other prokaryotic host

Specify:

Host strains:

Vectors:

Inserted DNA

**(include names of genes and organisms from which they were cloned):**

Will an attempt be made to express a foreign gene? Yes No

If yes, what protein will be produced?

Will whole virus or provirus be cloned? Yes No

Will the research involve the use of antibiotic selection markers? Yes No

If yes, list the markers and microbial agents used (e.g. neomycin resistance marker in *E. coli*)

NIH Guideline Section:

Recommended Biosafety Level:

B. Eukaryotic cells

Type:

Host cells:

Vectors:

All Packaging Plasmids used with your expression vectors:

Inserted DNA:

Will an attempt be made to express a foreign gene?  Yes  No

If yes, what protein will be produced?

Helper virus or packaging cells if used:

What fraction of a eukaryotic viral genome is contained in the recombinant or synthetic nucleic acid molecules (including vector and/or packaging plasmids or packaging cell lines)?

Check appropriate range:  <1/2       >1/2 but <2/3       >2/3

NIH Guideline Section:

Recommended Biosafety Level:

Will the research involve the use of antibiotic selection markers?  Yes  No

If yes, list the markers and microbial agents used (e.g. neomycin resistance marker in *E. coli*)

C. Whole plants or animals (any member of the kingdom Animalia) be used as hosts

Type:

Plant or animal hosts:

Vectors:

Inserted DNA:

What fraction of a eukaryotic viral genome is contained in the recombinant or synthetic nucleic acid molecules (including vector and packaging cell line)?

<2/3       >2/3

Will transgenic plants or animals be constructed or used?    Yes    No

Has a Yale IACUC registration been filed for your research experiments with vertebrate animals?

Yes    No

NIH Guideline Section:

Recommended Biosafety Level:

Will you cross-breed two or more genetically modified rodents or plants?    Yes    No

If yes, please answer the questions below:

Note: Generation of transgenic rodents by breeding to create a new strain shall be EXEMPT from the NIH Guidelines if the following criteria are met.

Yes    No    Both parental rodents can be housed under BSL1 containment; AND

Yes    No    Neither parental transgenic rodent contains the following genetic modifications:

- Incorporation of more than 50% of the genome of an exogenous eukaryotic virus from a single family of viruses; OR
- Incorporation of a transgene that is under the control of a gammaretroviral long terminal repeat (LTR); AND

Yes    No    The transgenic rodent that results from this breeding is not expected to contain more than 50% of an exogenous viral genome from a single family of viruses.

## D Additional Information

For recombinant or synthetic nucleic acid molecule experiments, do the genes involved or expressed involve potential:		<b>Provide full name of genes in each category</b> (provided the full scientific names for all the abbreviations on the form)
Toxicity	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Cell cycle/Cell division regulators	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Regulatory genes for transcription and cell activators (cytokines, lymphokines, and tumor suppressors)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Structural Proteins, Membrane Proteins	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Enzymatic Proteins and Metabolic enzymes	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Cell growth	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Tracking genes (i.e. GFP)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Allergenicity or other risk to research personnel	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Oncogenicity (cellular or viral oncogenes) or tumor suppressor genes	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Other potential risk to researchers handling the recombinant or synthetic nucleic acid molecules in this application?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	

### CRISPR or Other Gene Editing Technology

<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, answer questions <b>below</b> .	Does your research involve CRISPR or other gene editing technology?
	Please indicate which technology (CRISPR/Cas9, Zinc Finger nucleases, TALENS, Meganucleases, other?)
<input type="checkbox"/> Yes <input type="checkbox"/> No	For CRISPR systems, is the gRNA and nuclease on the same plasmid, vector or delivery vehicle?
<input type="checkbox"/> Yes <input type="checkbox"/> No	Can this plasmid, vector or delivery vehicle transfect or infect a human cell?
<input type="checkbox"/> Yes <input type="checkbox"/> No	For CRISPR research involving viral vectors, has a GT Scan for off target effects by your gRNA been completed? This is helpful in assessing the risk of potential exposure in the event of an incident.



## Gene Transfer Research Using Gene Editing Technologies

Are you planning human gene transfer research using gene editing technologies? Yes No

**Note:** No gene editing of the germ line human embryos or germ cells for clinical application is allowed. Gene editing of human embryos and germ cells for scientific purpose may be allowed, but must be evaluated on a case by case basis by the appropriate federal and local scientific review committees.

## Gene Drive Experiments

<input type="checkbox"/> Yes <input type="checkbox"/> No	Will the experiment make transgenic, sexually reproducing organisms?
<input type="checkbox"/> Yes <input type="checkbox"/> No	Is an entire CRISPR system encoded in a single DNA construct?
<input type="checkbox"/> Yes <input type="checkbox"/> No	Could it self-insert into the genome?
	<b>If you answered yes to all three questions above, answer yes to the following question.</b>
<input type="checkbox"/> Yes <input type="checkbox"/> No	Are you performing a gene drive experiment?

### III. Describe the Biohazard Potential of these Experiments:

The risks associated with the transgene and chance of generating replication competent virus must be considered.

If using defective lentiviral or retroviral vectors risks also include insertional mutagenesis, which can lead to activation of oncogenes, inactivation of tumor suppressor genes, and gene disruption.

- A. Provide the risks associated with the vector(s) being used including ability of the vector to infect researchers.
  
- B. Address the risks associated with the inserted nucleic acid. (If using defective lentiviral or retroviral vectors risks also include insertional mutagenesis, which can lead to activation of oncogenes, inactivation of tumor suppressor genes, and gene disruption).
  
- C. What are the consequences of exposure if a researcher is exposed to the recombinant molecules described on this protocol?
  
- D. What are the treatment options in the event of an occupational exposure?
  
- E. What are the suggested medical follow-up steps required after an exposure?
  
- F. Are there any medical surveillance requirements for the research materials described in this protocol?
  
- G. What are the chances of the formation of a replication competent vector (if your vector is replication defective)?

Please note: Anyone who is currently pregnant or immunosuppressed must contact Employee Health (432-7978) before working with the agent in question.

## **Registration of Research Experiments with Recombinant or Synthetic Nucleic Acid Molecules**

### **IV. Description of Experiment:**

- 1) Describe the goals of the research and potential benefits in sufficient detail to clarify the scientific basis of the work:
- 2) Indicate the desired start date for each phase of the work:
- 3) Provide key and relevant references to assist the Committee in their review of your request to perform the described experiment:

### **V. PERSONNEL (Names, Status and Telephone):**

**RESEARCHER EXPERIENCE FORM**  
**(Required for the PI and each researcher listed in Section V - Personnel)**

Name: \_\_\_\_\_

Job Title: \_\_\_\_\_

Principal Investigator: \_\_\_\_\_

Date: \_\_\_\_\_

**Education** (Degrees and programs completed):

<b>Date</b>	<b>Institution</b>	<b>Major Area</b>	<b>Degree</b>

**Laboratory experience related to work with microorganisms or cell culture:**

<b>Dates</b>	<b>Institution</b>	<b>Description of work and name of microorganisms (include the genus and species)</b>