

## **Recombinant DNA Safety**

### **Introduction**

The National Institute of Health's (NIH) Guidelines for Research Involving Recombinant DNA Molecules

(NIH Guidelines) was published in the 1970s in response to scientists' concerns about the dangers of creating recombinant organisms. It has been revised and updated many times since then, but is still the

standard for classifying recombinant deoxyribonucleic acid (rDNA) experiments according to hazard and

recommending appropriate containment levels.

### **IBC Approval**

IBC approval is required prior to the initiation of non-exempt recombinant or synthetic nucleic acid molecule experiments.

Exempt recombinant or synthetic nucleic acid molecule experiments must be registered with the Office of Laboratory Safety.

### **Guidelines**

At the University, research involving rDNA that is funded by NIH, must comply with NIH Guidelines.

<http://www4.od.nih.gov/oba/rac/guidelines/guidelines.html>

[http://osp.od.nih.gov/sites/default/files/NIH\\_Guidelines\\_0.pdf](http://osp.od.nih.gov/sites/default/files/NIH_Guidelines_0.pdf)).

### **General**

The NIH Guidelines are intended to assist the University and the principal investigator in determining

appropriate safeguards that should be implemented.

The purpose of the NIH guidelines is to specify practices for constructing and handling:

- Recombinant DNA molecules
- Organisms and viruses containing recombinant DNA molecules

### **Definition**

Recombinant and synthetic nucleic acid molecules are defined<sup>1</sup> as:

- (i) molecules that a) are constructed by joining nucleic acid molecules, and b) can replicate in a living cell (i.e. recombinant nucleic acids);
- (ii) nucleic acid molecules that are chemically or by other means synthesized or amplified, including those that are chemically or otherwise modified but can base pair with naturally occurring nucleic acid molecules(i.e. synthetic nucleic acids); or
- (iii) molecules that result from the replication of those described in (i) or (ii) above

## **Responsibilities**

At the University, general responsibilities relating to health and safety in the laboratory are described in the Chemical Hygiene and Exposure Control Plans.

The principal investigator (PI) is responsible for full compliance with the NIH Guidelines in the conduct of recombinant DNA research. The PI must notify the Office of Risk Management before any NIH-funded research involving rDNA is conducted.

## **Applicable Regulations**

NIH Guidelines for Research Involving Recombinant DNA Molecules: Though technically not a regulation, NIH requires that any institution receiving NIH funding comply with this document.

## **Exempt Experiments**

The following recombinant or synthetic nucleic acid molecules are exempt from the NIH Guidelines and registration with the Institutional Biosafety Committee is not required; however, other federal and state standards of biosafety may still apply to such research (for example, the Centers for Disease Control and Prevention (CDC)/NIH publication Biosafety in Microbiological and Biomedical Laboratories).

- Those synthetic nucleic acids that: (1) can neither replicate nor generate nucleic acids that can replicate in any living cell (e.g., oligonucleotides or other synthetic nucleic acids that do not contain an origin of replication or contain elements known to interact with either DNA or RNA polymerase), and (2) are not designed to integrate into DNA, and (3) do not produce a toxin that is lethal for vertebrates at an LD50 of less than 100 nanograms per kilogram body weight
- Those that are not in organisms, cells, or viruses and that have not been modified or manipulated (e.g., encapsulated into synthetic or natural vehicles) to render them capable of penetrating cellular membranes.
- Those that consist solely of the exact recombinant or synthetic nucleic acid sequence from a single source that exists contemporaneously in nature.
- Those that consist entirely of nucleic acids from a prokaryotic host, including its indigenous plasmids or viruses when propagated only in that host (or a closely related strain of the same species), or when transferred to another host by well-established physiological means.
- Those that consist entirely of nucleic acids from a eukaryotic host including its chloroplasts, mitochondria, or plasmids (but excluding viruses) when propagated only in that host (or a closely related strain of the same species).

- Those that consist entirely of DNA segments from different species that exchange DNA by known physiological processes, though one or more of the segments may be a synthetic equivalent. A list of such exchangers will be prepared and periodically revised by the NIH Director with advice of the RAC after appropriate notice and opportunity for public comment (see Section IV-C-1-b-(1)-(c), Major Actions).
- Those genomic DNA molecules that have acquired a transposable element, provided the transposable element does not contain any recombinant and/or synthetic DNA.
- Those that do not present a significant risk to health or the environment.

### **Resources**

1. (NIH GUIDELINES FOR RESEARCH INVOLVING RECOMBINANT OR SYNTHETIC NUCLEIC ACID MOLECULES November 2013) Accessible at: [http://osp.od.nih.gov/sites/default/files/NIH\\_Guidelines\\_0.pdf](http://osp.od.nih.gov/sites/default/files/NIH_Guidelines_0.pdf)
2. NIH office of Biotechnology Activities. [http://osp.od.nih.gov/office-biotechnology-activities/rdna/nih\\_guidelines\\_obo.html](http://osp.od.nih.gov/office-biotechnology-activities/rdna/nih_guidelines_obo.html)