

INTRODUCTION TO BIORISK MANAGEMENT

PERSONAL PROTECTIVE EQUIPMENT

Assoc. Prof. Dr. Kenneth F. Rodrigues
Biotechnology Research Institute

LICENSE



This work is licensed under a [Creative Commons Attribution-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-sa/4.0/).

Attribution — You must give [appropriate credit](#), provide a link to the license, and [indicate if changes were made](#). You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the [same license](#) as the original.



INTRODUCTION

This lecture has been designed and developed to introduce you to the personal protective equipment (PPEs) which constitute the last line of defence against biological agents. The **judicious** use of PPEs is essential in order to manage biorisks effectively.



This Photo by Unknown author is licensed under [CC BY](#).



LEARNING OBJECTIVES

The objectives of this lecture are to introduce you to:

1. The **different types** of PPEs.
 2. The **selection** of PPEs based on risk assessment.
 3. Standard Operating Procedures (**SOPs**) and PPEs.
 4. **Specialized** PPEs.
-




LEARNING OUTCOMES

Upon completion of this module you should demonstrate the ability to:

1. **Describe** the various types of PPEs.
 2. **Select** PPEs to mitigate the risk posed by biological agents.
 3. **Understand** how administrative controls must be used concurrently with PPEs.
-

A person wearing a full-body blue protective suit, a white hood, and a clear face shield is working inside a biosafety cabinet. They are wearing yellow gloves and using a pipette to transfer liquid into a multi-well plate. A black flexible exhaust hose is connected to the back of the suit. In the background, inside the cabinet, there is a bottle of orange liquid and other laboratory equipment.

TYPES OF PPEs



TYPES OF PPEs

- Masks.
 - Gloves.
 - Protective suits.
 - Protective eyewear.
 - Specialized PPEs.
-

MASKS & RESPIRATORS

- Biological agents which are transmitted via **aerosols**.
 - Route of entry via the **airway**.
 - Wide range of masks.
 - The **N95** respirator.
 - **Fit testing** of masks.
 - **Reuse** of masks.
 - Standards for mask: **EN 149:2001+A1:2009** (European Committee for Standardization)
-



THE N95 RESPIRATOR

- Standard N95 Respirator 3M Model **8210**
- Surgical N95 Respirator 3M Model **1860**
- Surgical N95 Respirator 3M Model **1870+**



N95 (3M MODEL 8210)

- Designed to help protect the wearer from exposure to airborne particles (e.g. Dust, mist, fumes, fibers, and bioaerosols, such viruses and bacteria).
 - Designed to fit tightly to the face and create a seal between the user's face and the respirator.
 - Meets NIOSH 42 CFR 84 N95 requirements for a minimum 95% filtration efficiency against solid and liquid aerosols that **do not contain oil**.
 - **NOT CLEARED by U.S. FDA as a surgical mask.**
 - **NOT FLUID RESISTANT.**
-





GLOVES

- Latex gloves.
- Nitrile gloves.
- Double gloving.
- Reinforced gloves.

PROTECTIVE SUITS

- Protective suits are designed to protect the user from exposure to the biological agent.
- Can be worn both in the laboratory and in the field.
- Protects against minor splashes but cannot be used to mitigate major spills.
- One-time usage.
- High cost.





PROTECTIVE EYEWEAR

- Designed to protect entry of the biological agent via the ocular route.
- Face shield protect the user against minor splashes.
- Power Air Purifying Respirators (PAPR) are recommended when managing high throughput.

POWERED AIR PURIFYING RESPIRATORS

- Designed to protect the laboratory user from aerosols that can be generated in the laboratory.
 - A downdraft of filtered air flows constantly over the face of the user.
 - The face shield: ocular protection.
 - The apron: serves as a plenum for the downward direction of air.
 - Recommended usage: 3 hours.
-





VIDEO ON DONNING OF THE PAPR

- Please visit the following URL in order to view a video which has been developed specially for this

MOOC: <https://youtu.be/vH7j3U2WAf4>

PRESSURIZED SUITS (BSL4)

The pressurized suit is only donned when managing biological agents which pose a high individual risk and a high community risk.





SELECTION OF PPEs



BIOLOGICAL AGENT

RISK GROUP	GLOVES	RESPIRATOR	BIOSAFETY SUIT	PAPR	PRESSURIZED SUIT
1	X	X			
2	X	X	X	X	
3	X		X	X	
4	X		X		X
NOVEL	X		X		X

PORTAL OF ENTRY

PORTAL OF ENTRY	GLOVES	RESPIRATOR	BIOSAFETY SUIT	PAPR	REINFORCED GLOVES
OCULAR	X	X	X	X	
RESPIRATORY	X	X	X	X	
CUTANEOUS	X		X	X	
PERCUTANEOUS	X		X		X
MULTIPLE	X	X	X	X	X

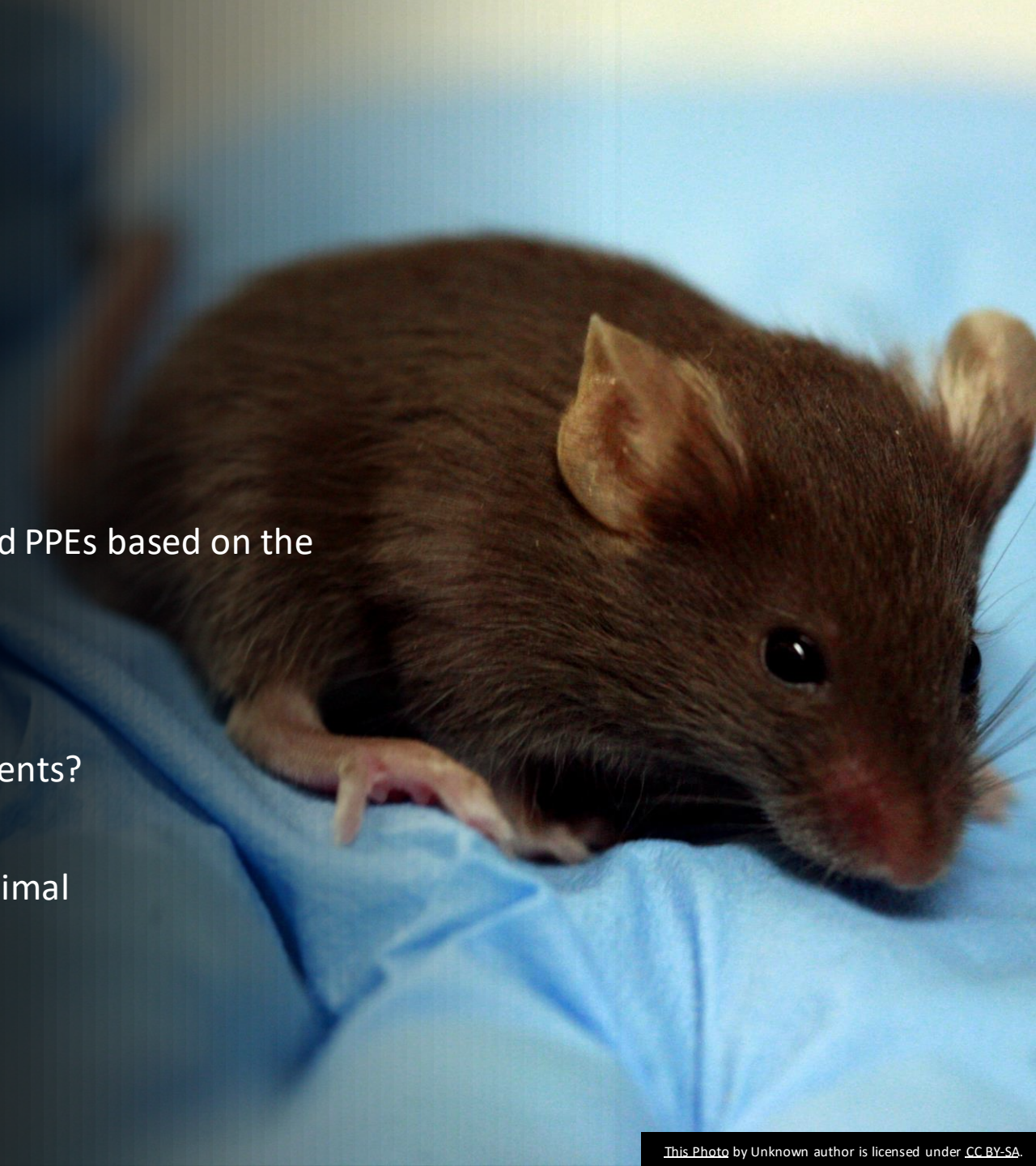
LABORATORY PROCEDURES

LABORATORY PROCEDURE	GLOVES	RESPIRATOR	BIOSAFETY SUIT	PAPR	REINFORCED GLOVES
SAMPLE RECEIPT	X	X	X		
SAMPLE TRANSFER	X	X	X	X	
IMMUNOLOGY	X	X	X	X	
NUCLEIC ACID EXTRACTION	X	X	X	X	
POLYMERASE CHAIN REACTION	X	X	X	X	
WASTE HANDLING	X	X	X		
ANIMAL LABS	X		X	X	X

WORKING WITH ANIMALS

Working with animals necessitates the usage of specialized PPEs based on the following criteria:

- What is the size of the animal?
- Behavior: aggressive?
- Reservoir for potential human pathogens? Zoonotic agents?
- Field Work or Laboratory Work?
- Portal of entry of the biological agent carried by the animal



PPEs and ADMINISTRATIVE CONTROLS

- The selection of PPEs must be done after a **thorough risk assessment**.
 - The choice of PPEs depends on the risk group and the **laboratory procedure**.
 - Laboratory users must be trained to **"don"** and **"doff"** PPEs in compliance with SOPs.
 - All **incidents and accidents** involving PPEs must be documented and reported during the audit.
 - PPEs: **expiry dates**.
 - PPEs: must be **disposed** in accordance with SOPs for waste handling.
-



Risk Group?



Portal of Entry?



Laboratory procedure?



THANK YOU