

Molecular Biology Laboratory

Lab 1: Laboratory safety rules

Safety: means to be cautious about our environment and to protect those around us by using safety tips and exercising caution in our homes, workplaces, and on the road. BSAFE stands for always being safety-conscious about everything around us. We need to be aware of our surroundings and ensure that we create a safe environment for ourselves and others.

*Safety is not an option... it's a responsibility

*In the workplace, nothing comes before safety.

*It's not just a set of instructions on the wall or procedures at the start of a project — it's a daily culture and behavior that protects lives and sustains productivity.

*Safety starts with you: by committing to wear your PPE.

*Safety continues with the team: through cooperation and reporting hazards.

*Safety means the future: every preventive action today is an investment in tomorrow.

Let's always put safety at the top of our priorities, and make it an inseparable part of our work culture. Because true success begins when we all return home safely every day.

Lab Safety

Never wear open-toed shoes in the lab.



Always discard any broken glass in the broken glass container.



Never leave garbage in around the classroom. Always clean it up.



If chemicals get in your eyes, use the eyewash station to clean them.



Always wear safety goggles when working in the lab.



No food or drinks in the lab.



Always wear safety gloves when working in the lab.



Risk Groups and Biosafety Levels in Labs

Relation of Risk Groups (RG) and Biosafety Levels (BSL)







RG-1 = BSL-1

Description: very low risk, unlikely to cause disease. Examples: *Bacillus subtilis*, *E. coli* K-12. Lab: Basic microbiology lab, no special barriers.



RG-2 = BSL-2

Description: Moderate risk, treatable infections. Examples: Staphylococcus aureus, Salmonella typhi, Hepatitis A virus. Lab: Personal protective equipment (PPE), Class II BSC, restricted access, autoclave waste.

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|--|---|---|
|  <p>Biosafety level 1</p> <p>Example of agent :</p>  <p>E.coli (non-pathogenic)</p> | <p>Safety Equipments (Primary)</p>  | <p>Secondary Barriers (Facilities)</p> <ul style="list-style-type: none"> • Normal doors • Water sink • Cleanable furniture • Physically linked building |
|  <p>Biosafety level 2</p> <p>Example of agent :</p>  <p>Zika virus</p> | <p>Safety Equipments (Primary)</p>  | <p>Secondary Barriers (Facilities)</p> <ul style="list-style-type: none"> • Self-closing doors • Installed biosafety cabinet (II) • Heat and chemical resistant bench • Eye wash station • Windows are not recommended • Cleanable furniture |

RG-3 = BSL-3

Description: High risk, may cause lethal disease, aerosol transmission possible. Examples: Mycobacterium tuberculosis, SARS-CoV-2, Rabies virus. Lab: Negative pressure, High-Efficiency Particulate Air (HEPA) filter or HEPA-filtered exhaust, work inside Class II/III BSC.

RG-4 = BSL-4

Description: Very high risk, often fatal, no treatment or vaccine. Examples: Ebola, Marburg, Nipah, Lassa, Smallpox virus. Lab: Isolated facility, positive-pressure suits, Class III BSC/glove boxes, chemical decontamination.

Relation of Biosafety Level and Risk Group

| Risk Group | Description | Examples | Biosafety Level |
|-------------|--|---|---|
| RG-1 | No or very low risk to healthy individuals: unlikely to cause disease | <i>Bacillus subtilis</i> Salmonella coli K-12 | Basic microbiology lab, no special equipment |
| RG-2 | Moderate risk, can cause human/ animal disease but rarely serious. aseriable | <i>Staphylococcus aureus</i> Salmonella typhi Hepatitis A virus | PPE, biosafety cabinets restricted access biohazard signs |
| RG-3 | High risk, serious or lethal disease, potential aerosol transmits | <i>Mycobacterium tuberculosis</i> SARS-CoV-2 | Controlled access negative pressure BSC-military BSC |
| RG-4 | Very high risk, often fatal, no transmission or therapy | <i>Ebola virus</i> Marburg virus | Maximum containment, full-body protective pressure suit |

Why Are Biosafety Levels (BSL) Labs Important?

1. They introduce students to microbiological practices in a real lab setting.
2. They provide the foundation for future work in higher-level biosafety labs.

Safety Practices in Biosafety Levels (BSL-1) Labs

BSL-1 labs follow Standard Microbiological Practices such as:

1. Wearing lab coats, gloves, and closed-toe shoes
2. Washing hands before and after lab work
3. Disinfecting work surfaces before and after use
4. Proper labeling and disposal of cultures
5. Sharps disposal protocols and emergency preparedness

What Happens in a Biosafety Levels (BSL-1) Lab?

1. Aseptic techniques (preventing contamination)
2. Microbial culturing (growing bacteria on agar plates)
3. Gram staining and microscopy
4. Measuring microbial growth
5. Antibiotic susceptibility testing
6. Biochemical testing (e.g., catalase, oxidase, sugar fermentation)

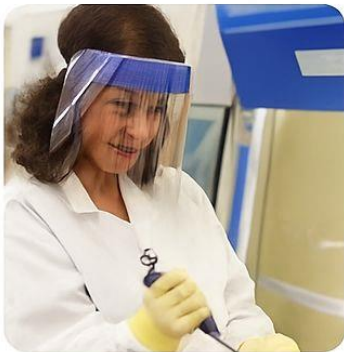
□ Biosafety Levels (BSL)



BSL-1

Basic labs

- Non-pathogenic microbes
- PPE: Lab coat, gloves



BSL-2

Clinical labs

- Moderate-risk pathogens
- PPE: Lab coat, gloves, shield



BSL-3

High-containment labs

- Airborne pathogens (e.g., TB)
- PPE: Respirator, biosafety cabinets



BSL-4

Maximum containment labs

- Deadly pathogens (Ebola, Marburg)
 - PPE: Full-body suit, airlock entry
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Biological waste:

Biological waste must be disposed of an important distinction should be made between biological waste that has been inactivated before disposal, and biological waste that has not been inactivated before disposal. The latter has to be treated as hazardous medical waste and should be transported to an incinerator that is suited for the incineration of hazardous medical waste.

Biological waste includes:

- All genetically modified and/or pathogenic biological material: cell cultures, cultures of Microorganisms, tissues, blood, etc.
- Typical laboratory waste of organic origin: gels, etc.
- All kinds of biologically contaminated material: gloves, paper tissues, disposable culture flasks, pipettes, etc.
- Materials that are not necessarily contaminated, but cannot be thrown into an ordinary waste disposal bag because they have sharp edges or look dirty (bones, blood, etc.).

Biological waste does not include:

- Radioactive contaminated material. Such material should be dealt with separately.

**BIOSAFETY
LEVEL 1**



**BIOSAFETY
LEVEL 2**



**BIOSAFETY
LEVEL 3**



**BIOSAFETY
LEVEL 4**

