Biosafety levels and risk groups

Risk groups

- In many countries, biological agents are categorized in Risk Groups (RG) based on their relative risk.
- Depending on the country or organization, this classification system take the following factors into consideration:

Factors of Risk group classification

- ✓ Pathogenicity of the organism
- ✓ Individual and community risk
- ✓ Mode of transmission and host range
- ✓ Availability of effective preventive measures (e.g., vaccines)
- ✓ Availability of effective treatment (e.g., antibiotics)

Risk group range

- Biological agents (Organisms) are classified into four risk groups (RG1, RG2, RG3 and RG4).
- It is important to understand that they are categorised in a graded fashion such that the level of hazard associated with **RG1 being the lowest** and **RG4 being the highest**.

Risk group classification

- Risk Group1 (**RG1**) agents are not associated with disease in healthy adult humans or animals.
- Risk Group2 (**RG2**) agents are associated with human disease which is **rarely serious** and for which **preventive or therapeutics** are **often available.**
- Risk Group3 (**RG3**) agents are associated with **serious or lethal** human disease for which **preventive or therapeutics may be available**.
- Risk Group4 (**RG4**) agents are likely to cause **serious or lethal** human disease for which **preventive or therapeutics** are **not usually available**.

Biosafety Levels

- In contrast to Risk Groups, Biosafety Levels (BSL) prescribe procedures and levels of containment for the particular microorganism or material.
- Similar to Risk Groups, BSL are ranked from one to four (BSL1, BSL2, BSL3 and BSL4).
- Biosafety levels are selected based on the agents or organisms on which the research or work is being conducted.
- Each level builds up on the previous level, adding constraints and barriers.

Biosafety Level 1

- Suitable for work involving well characterized agents not known to cause disease in healthy adult humans, animals and the environment.

- **Standard practices required:**
  - Fallowing all the laboratory instructions.
  - Using the proper personal protective equipment (lab coats, latex gloves, eye protection, etc.)
  - Door that can be kept closed when working
  - Limits on access to the lab space when working
  - Decontamination of laboratory wastes
  - Use of mechanical pipettes only (no mouth pipetting)

Biosafety Level 2

- Suitable for work involving agents of moderate potential hazard to personnel and the environment.
- Do not cause lethal infections, are not transmissible via airborne route

- **Standard practices include BSL1 plus:**
  - Policies to restrict access to the lab
  - Biohazard warning signs posted outside the lab

Biosafety Level 3

Suitable for work with infectious agent which may cause serious or potentially lethal disease as a result of exposure by the inhalation rote.

- **Standard practices include BSL2 plus:**
  - Strictly controlled access to the lab.
  - Specific training for lab personnel in handling potentially lethal agents
  - Decontaminating all waste
  - Changing contaminated protective lab clothing, decontaminating lab clothing before laundering

Biosafety Level 4

- Suitable for work involving exotic infectious agents that pose a high risk of life-threatening disease.

- **Standard practices include BSL3 plus:**
  - Changing clothing before entering and exiting lab (showering upon exiting recommended).
  - Decontaminating all material exiting facility.

Example

Risk Group	Biosafety Level	Examples
RG1	BSL1	Non pathogenic *Escherichia coli*, *Saccharomyces cerevisiae*
RG2	BSL2	*Staphylococcus aureus*, *Streptococcus pyogenes*
RG3	BSL3	Human Immune Virus (HIV), *Bacillus anthracis*, SARS-CoV-2
RG4	BSL4	Ebola virus, Marburg virus

Biohazard warning sign for laboratory doors