



# LAB SAFETY

Ufficio Prevenzione e Protezione internal use only  
[prevenzione.sicurezza@uninsubria.it](mailto:prevenzione.sicurezza@uninsubria.it)

# Biological Laboratories



## Definitions

- **Biological agent** any micro organism, including the GMO, cell lines and human endoparasite that may cause infections, allergy or intoxication (bacteria, fungus, parasites, viruses)
- **Micro organism** any microbiological entity cellular or less, able to reproduce itself or to transfer *genetic material*
- **Cell culture** the result of cells growth under controlled conditions, outside their natural environment
- **Genetically modified microorganism** *micro organism whose genetic material has been modified by genetic laboratory techniques*
- **Containment** *the set of procedures, structural requirements, machineries and job practices that allows a safe and secure biological practice.*



# Classification of infective microorganism

Risk group	Description	Biosafety level	Examples
1	Unlikely to cause human disease	Good lab practices	
2	Can cause human/animal disease but is unlikely to be a serious hazard. Effective treatment available.	2	H. pylori,
3	Represent a serious risk. Effective treatment and preventive measures available.	3	HIV, BSE, hepatitis B virus
4	Highly transmittable. Effective treatment not available.	4	Ebola Virus,



## General advices

In any lab is strictly forbidden to:

- Smoking, drinking, eating and storing food and beverages
- Using make-up and contact lenses
- Introducing bags and other personal items

It's suggested to:

- Remove rings, watches, necklaces
- Wear the hair in a bun (or similar)
- Avoid open-toed shoes
- Wear practical clothes.



## General advices

Remember:

- Never work alone
- Follow your teacher indications
- Do not try to do other activities
- Do not use instruments and/or devices you are not trained to.



## General advices

- Always wear lab coat inside the lab
- Always use disposable gloves
- Wear safety glasses or face shield if required
- Don't wear lab coat and/or gloves outside the lab
- Take off gloves before using phones, PCs, printers in the lab
- Wash carefully your hands after every activity and at the end of the work
- Wash carefully your hands in case of rupture of safety gloves.



## General advices

- Consider any biological sample as an hazardous one, do apply every general advice
- Never pipetting by mouth, always use pipette aid
- Reduce hypodermic needles and sharp lancets use
- Don't recap hypodermic needles after use, use the sharp disposal safety box
- don't try to stop a sharp lancet/needle in case of fall, let it fall freely
- Be careful if moving inside the lab, be sure other users will notice you.





## General advices

- Keep the lab clean and neat
- Don't introduce in the lab anything unrelated to working activities
- Open carefully vials and containers
- Avoid aerosols and droplets
- Keep samples in airtight containers
- Any container has to be decontaminated (outside) and properly labeled.



## General advices

- Use Biosafety Cabinet when necessary (group 2 and 3 microorganism)
- Put the biohazard warning sign outside the lab
- Put the biohazard warning sign on lab devices, refrigerators, waste boxes, etc.
- Clean and decontaminate any instrument and lab device before maintenance.



## General advices

- In case of spill cover the area with blotting paper soaked by disinfectant, let it act, remove the paper and disinfect again
- Always notice your Lab Responsible in case of accidental spill for proper waste discard
- Store waste in the proper containers inside the lab; use proper hypodermic needles safety box
- Don't use waste bins outside the lab to discard lab waste
- Clean and decontaminate instruments and benches at the end of the activity.



## Hands washing

Always wash your hands:

- In case of rupture
- In case of accidental contact
- After taking off gloves
- At the end of any activity
- Before eating, drinking, using make-up, handling contact lenses or other personal items
- After using toilets.



## Hands washing

### Washing instructions:

- Remove rings, bracelets, watches
- Lather up fingers, palms, backs, nails and wrists for 30"
- Rinse
- Dry with disposable paper towels
- Close tap with disposable towel.



## Disinfection and sterilization

- **Disinfection:** *strong microorganism reduction from objects, benches, environment, etc.*
- **Sterilization:** *complete removal of every microorganism by chemical/physical means, from objects and environment.*

Disinfectant (examples)	Use
Ethanol	Only on intact skin, keep for 2' min. May cause skin dryness and/or irritation. Efficiency increased if used with other active substances as Iodine and derivate. Volatile and flammable.
Iodine and iodophors	Potentially irritant for skin; used in low concentration, in aqueous base, are suitable for small wounds.
Chlorine derivates	For organic/blood contaminated objects and surfaces. To be used at 5000-10000 ppm concentration. Not to be used in presence of acid spills. Harmful for metals. Toxic substances, use safety glasses and gloves.



## Biosafety cabinet (BSC)

- check the BSC is eligible for the bio sample in use
- Check the BSC works properly (with a sheet of paper or similar)
- Turn BSC on at least 15' before beginning the manipulation
- Turn on the UV germicidal lamp (if required) 15' before start working
- Put inside the BSC all you need
- Avoid the other introduction after beginning
- Work as close as possible to the back of the BSC.



## Biosafety cabinet

- Avoid forearms abrupt movements: it may cause overpourings and flux alterations
- Remove all the contaminated/infected material and discard in air-tight containers. Containers have to be cleaned and properly labelled
- Keep the flux working for 15' after the work end
- Clean and disinfect the BSC after every use.





# SBC

CLASS	% room air recirculation	Main characters	Use	Operator protection	Environment protection	Sample protection
I		Restraint and safety guaranteed by room air drawn. HEPA filtered exhaled air.	Group 1-2	Good	Optimal	Low
II A	70	Vertical laminar flux in the working area HEPA filtered air on both sides (inhale and exhale),	Group 2-3	Good	Optimal	Optimal
II B 1	30					
II B 2	0					
III glove box		Air-tight sealing, negative pressure inside, glove box. Single HEPA filter for inhale air, double HEPA filter on exhaust side.	Group 4	Optimal	Optimal	Good



## Individual protection devices

The most common are:

- Lab coat
- Disposable gloves
- Safety glasses, face shields, screens
- Protective mask

Any worker:

- Use correctly
- Avoid any modification
- Take care, keeping them clean and disinfected
- Notice any damage, problems, drawbacks.

# Chemical labs



## Definitions

- **Chemical agent** *any chemical product used during lab practice*
- **Substance** *every chemical elements and its compounds and mixtures, natural or obtained by any process*
- **Compounds** *mixture or solution made with different substances*
- **Chemical Hazard/risk** exposure to risk due to manipulation of chemicals



## Classification

Any chemical could be classified by:

### **a) Label**

Commercial name

- Chemical name of the most significant substance by toxicological point of view;
- Preeminent risk pictogram;
- H/EUH phrases (risk phrases);
- P phrases (precautionary phrases);
- Quantity;
- Name, address, producer / importer / reseller phone number.



### **b) European Material Safety Data Sheet (MSDS):**

1. Identification of the substance/mixture and of the company/undertaking
2. Hazard identification
3. Composition/information on ingredients
4. First aid measures
5. Firefighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure controls/personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information

# Pictograms

Pittogramma di pericolo e denominazione (regolamento CE 1272/2008)	Simbolo e denominazione (direttiva 67/548/CEE, obsoleta)	Significato (definizione e precauzioni)
 GHS01 ESPLOSIVO	 <b>E</b> <b>Esplorivo</b>	<p><b>Classificazione:</b> sostanze o preparazioni che possono esplodere a causa di una scintilla o che sono molto sensibili agli urti o allo sfregamento.</p> <p><b>Precauzioni:</b> evitare colpi, scuotimenti, sfregamenti, fiamme o fonti di calore.</p>
 GHS02 INFIAMMABILE	 <b>F</b> <b>INFIAMMABILE</b>	<p><b>Classificazione:</b> Sostanze o preparazioni che possono surriscaldarsi e successivamente infiammarsi al contatto con l'aria a una temperatura compresa tra i 21 e i 55 °C; acqua; sorgenti di innesco (scintille, fiamme, calore ...);</p> <p><b>Precauzioni:</b> evitare il contatto con materiali (come aria e acqua).</p>
	 <b>F+</b> <b>ESTREMAMENTE INFIAMMABILE</b>	<p><b>Classificazione:</b> sostanze o preparazioni liquide il cui punto di combustione è inferiore ai 21 °C.</p> <p><b>Precauzioni:</b> evitare il contatto con materiali (come aria e acqua).</p>

Pittogramma di pericolo e denominazione (regolamento CE 1272/2008)	Simbolo e denominazione (direttiva 67/548/CEE, obsoleta)	Significato (definizione e precauzioni)
 GHS03 COMBURENTE	 <b>O</b> <b>Comburente</b>	<p><b>Classificazione:</b> Reagendo con altre sostanze questi prodotti possono facilmente ossidarsi o liberare ossigeno. Per tali motivi possono provocare o aggravare incendi di sostanze combustibili.</p> <p><b>Precauzioni:</b> evitare il contatto con materiali combustibili.</p>
 GHS04 GAS SOTTO PRESSIONE	<p>(nessuna corrispondenza)</p>	<p><b>Classificazione:</b> bombole o altri contenitori di gas sotto pressione, compressi, liquefatti, refrigerati, disciolti.</p> <p><b>Precauzioni:</b> trasportare, manipolare e utilizzare con la necessaria cautela.</p>
 GHS05 CORROSIVO	 <b>C</b> <b>CORROSIVO</b>	<p><b>Classificazione:</b> questi prodotti chimici causano la distruzione di tessuti viventi e/o attrezzature.</p> <p><b>Precauzioni:</b> non inalare ed evitare il contatto con la pelle, gli occhi e gli abiti.</p>

Pittogramma di pericolo e denominazione (regolamento CE 1272/2008)	Simbolo e denominazione (direttiva 67/548/CEE, obsoleta)	Significato (definizione e precauzioni)
 GHS06 TOSSICO ACUTO	 <b>T</b> <u>TOSSICO</u>	<p><b>Classificazione:</b> sostanze o preparazioni che, per inalazione, ingestione o penetrazione nella pelle, possono implicare rischi gravi, acuti o cronici, e anche la morte.</p> <p><b>Precauzioni:</b> deve essere evitato il contatto con il corpo.</p>
 GHS08 TOSSICO A LUNGO TERMINE	 <b>T+</b> <u>ESTREMAMENTE TOSSICO</u>	<p><b>Classificazione:</b> sostanze o preparazioni che, per inalazione, ingestione o assorbimento attraverso la pelle, provocano rischi estremamente gravi, acuti o cronici, e facilmente la morte.</p> <p><b>Precauzioni:</b> deve essere evitato il contatto con il corpo, l'inalazione e l'ingestione, nonché un'esposizione continua o ripetitiva anche a basse concentrazioni della sostanza o preparato.</p>
 GHS07 IRRITANTE	 <b>Xi</b> <u>IRRITANTE</u>	<p><b>Classificazione:</b> sostanze o preparazioni non corrosive che, al contatto immediato, prolungato o ripetuto con la pelle o le mucose possono provocare un'azione irritante.</p> <p><b>Precauzioni:</b> i vapori non devono essere inalati e il contatto con la pelle deve essere evitato.</p>

Pittogramma di pericolo e denominazione (regolamento CE 1272/2008)	Simbolo e denominazione (direttiva 67/548/CEE, obsoleta)	Significato (definizione e precauzioni)
NOCIVO	 <b>Xn</b> <u>Nocivo</u>	<p><b>Classificazione:</b> sostanze o preparazioni che, per inalazione, ingestione o assorbimento cutaneo, possono implicare rischi per la salute non mortali; oppure sostanze che per inalazione o contatto possono causare reazioni allergiche o asmatiche.</p> <p><b>Precauzioni:</b> i vapori non devono essere inalati e il contatto con la pelle deve essere evitato.</p>
 GHS09 PERICOLOSO PER L' AMBIENTE	 <b>N</b> <u>Pericoloso per l'ambiente</u>	<p><b>Classificazione:</b> il contatto dell'ambiente con queste sostanze o preparazioni può provocare danni all'ecosistema (flora, fauna, acqua, ecc..) a corto o a lungo periodo.</p> <p><b>Precauzioni:</b> le sostanze non devono essere disperse nell'ambiente.</p>





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- Introducing bags and other personal items

It's suggested to:

- Remove rings, watches, necklaces
- Wear the hair in a bun (or similar)
- Avoid open-toed shoes
- Wear practical clothes.



## General advice

Remember:

- Never work alone
- Follow your teacher indications
- Do not try to do other activities
- Respect safety and warning signs
- Do not use instruments and/or devices you are not trained to.



## General advices

- Always wear lab coat inside the lab
- Always use disposable gloves
- Wear safety glasses or face shield if required
- Keep the lab clean and neat
- Read carefully the labels of the chemicals you are using
- Activities involving gas, fumes, vapours must be conducted in the fume hood
- In case of fire alarm and in any case of emergency, follow the teacher instructions and exit the lab.



## General advices

- Any change in the working routine, (quantities, reagents, etc.) may be dangerous and must be approved by Lab Responsible.
- Use pliers or safety gloves while handling hot containers.
- In case of contact with irritant substances, wash immediately with water the exposed part
- Notice immediately the Lab responsible in case of uneasiness or if you notice it.



## Precauzioni generali

- Handle carefully the lab glassware; always check the integrity before use
- Do not use glassware in case of damage – even slight – especially in case of vacuum applications
- Never touch electrical devices with wet hands; in case of water spill unplug immediately the bench
- Avoid any contact between electrical wires and heating plates and/or other hot surfaces
- Do not pour any liquid in the sink, unless being expressly authorized
- At the end of the work, wash carefully the glassware and leave the lab clean and neat.



## Fume hood

- Fume hood must be used in case of hazardous substances. The use is compulsory if indicated in the MSDS.
- Check the fume hood is suitable for the substance you are using
- Check the effectiveness of aspiration using a napkin or similar and lowering the frontal glass to 40 cm over the bench
- If the hood is equipped with automatic speed regulation, set the frontal glass as low as possible to allow a safe and comfortable work.
- In case of horizontally sliding glasses hood, keep them closed
- Do not lean your head inside the hood
- Keep under the hood the minimum amount of materials required for the activity
- Place the glassware and other items 15-20 cm inside the hood and enough far from the rear air intakes.



## Fume hood

- The operator should work a little away from frontal glass, to avoid turbulences;
- Electrical devices have to be connected outside the hood and, if necessary, ATEX certified;
- No electrical plugs are admitted inside the hood;
- Remote controls should be preferred, in order to avoid forearms movements inside the hood;
- Do not obstruct the air flow along the hood bench. If using cluttering devices, raise them for 5 cm (min.) and keep the hood walls clear.



## Fume hood

- In case of malfunction during the activity, stop working and notice the Lab. Responsible immediately
- Do not use the fume hood as a storage area
- Do not use the fume hood to force reagent disposal by evaporation
- When the fume hood is not in use, keep the frontal glass closed and turn off suction
- At the end of work, clean the bench and leave it neat.





## Useful numbers

In case of accident or incident even if slight – notice the Lab Responsible to start the necessary procedure.

- Emergency number (medical, fire, any emergency): 112
- Milano Niguarda anti - poisoning center : 02 66101029