Biosecurity & Biosafety
Types of Hood

Laboratory Safety

- Before working with chemicals, you should become familiar with the hazards of the materials
- When possible, replacement less hazardous materials (less toxic, less flammable, less reactive, avoid strong oxidizers, etc.)
- Train all new employees about the hazards of the chemicals in the lab.
- They should review the label and Safety Data Sheets for materials they will work with.
- Know the signs and symptoms of exposure to these chemicals.
- Understand the physical hazards (flammable, conditions of violent or explosive reaction).

Types of Hood/Ventilation Systems

- Laminar Flow Hood
- Chemical Fume Hood
- Biosafety Cabinet

Laminar Flow Hood

- **A Laminar flow hood/cabinet is an enclosed workstation used to create a contamination-free work environment through filters which capture all the particles entering the cabinet.**
- **These cabinets are designed to protect the work from the surrounding environment and are most useful for the aseptic distribution of specific media and plate pouring.**
- **A laminar flow cabinet or tissue culture hood is a carefully enclosed bench designed to prevent contamination of biological samples, or any particle sensitive materials.**

- **Laminar flow cabinets are similar to biosafety cabinets with the only difference being that in laminar flow cabinets the effluent air is drawn into the face of the user.**
- **In a biosafety cabinet, both the sample and user are protected while in the laminar flow cabinet, only the sample is protected and not the user.**

- **Designed to protect work only – no protection of the employee or room. Due to the direction of air flow (Air flow across the work surface into the employee face)**
- **The cabinet is usually made of stainless steel with no gaps or joints where spores might collect**
- **There are many different types of cabinets with a variety of air flow patterns .**
- **Laminar flow cabinets may have a UV-C germicidal lamp to sterilize the interior and contents before usage to prevent contamination of the experiment.**

- Germicidal lamps are usually kept on for fifteen minutes to sterilize the interior before the cabinet is used.
- The light must be switched off when the cabinet is being used, to limit exposure to skin and eyes as stray ultraviolet light emissions can cause cancer and cataracts
- No specific testing requirements
- Disinfect before and after each use

Parts of Laminar flow hood

- **A laminar flow cabinet consists of the following parts:**
- **Cabinet**
- **The cabinet is made up of stainless steel with less or no gaps or joints preventing the collection of spores..**
- **The front of the cabinet is provided with a glass shield eitheropens entirely or has two openings for the user's hands.**
- **Working station**
- **A flat working station inside the cabinet is made up of stainless steel to prevent rusting**
- **Culture plates, burner and loops are all placed on the working station where the operation takes place.**

- **Filter pad/ Pre-filter**
- **A filter pad is located on the top of the cabinet through which the air passes into the cabinet.**
- **The filter pad traps dust particles and some microbes from entering the working environment within the cabinet.**
- **Fan/ Blower**
- **A fan is present below the filter pad that sucks in the air and moves it around in the cabinet.**
- **The fan also allows the movement of air towards the HEPA filter, so the remaining microbes become trapped while passing through the filter.**
- **UV lamp**
- **Some laminar flow hoods might have a UV germicidal lamp that sterilizes the interior of the cabinet and contents before the operation.**
- **The UV lamp is turned on for 15 minutes before the operation to prevent the exposure of UV to the body surface of the user.**

- **Fluorescent lamp**
- Florescent light is placed inside the cabinet to provide proper light during the operation.
- **HEPA filter**
- The **High-Efficiency Particulate Air** filter makes the inside environment more sterile for the operation.
- The pre-filtered air passes through the filter which traps fungi, bacteria and other dust particles.
- The filter ensures a sterile condition inside the cabinet, thus reducing the chances of contamination.

Types of laminar flow cabinet

Vertical laminar flow cabinet

- **In the vertical flow cabinets, the air moves from the top of the cabinet directly towards the bottom.**
- **A vertical airflow working bench does not require as much depth and floor space as a horizontal airflow hood which makes it more manageable and decreases the chances of airflow obstruction or movement of contaminated air downstream.**
- **The vertical laminar flow cabinet is also considered safer as it doesn't blow the air directly towards the person carrying out the experiments.**

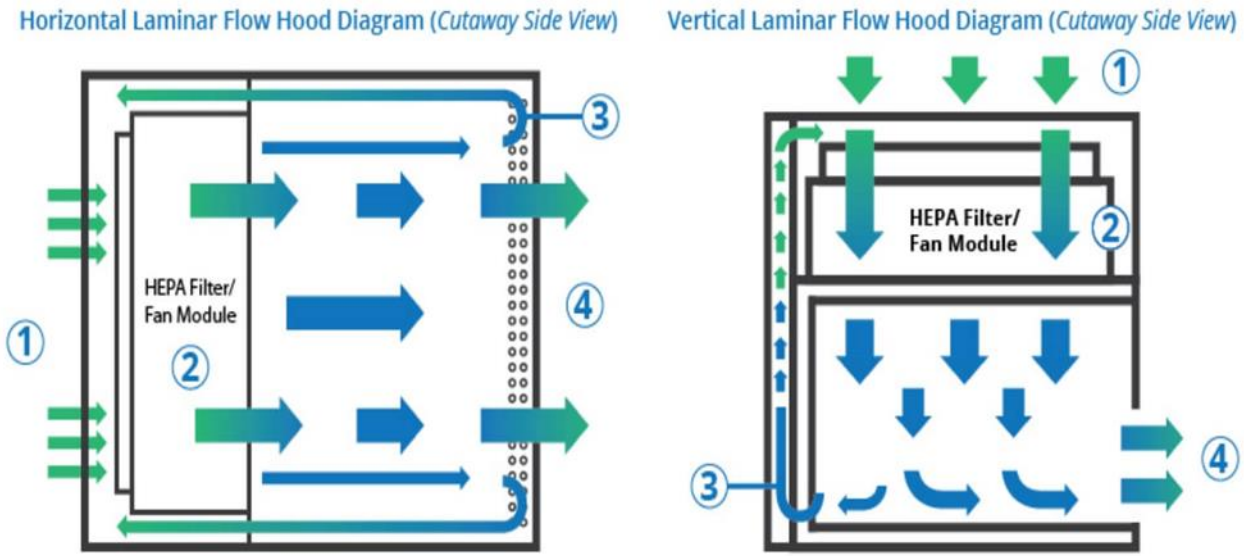
Vertical laminar flow cabinet

Horizontal laminar flow cabinet

- In the horizontal laminar flow cabinets, **the surrounding air comes from behind the working bench**, which is then projected by the blower towards the HEPA filters.
- The filtered air is then exhausted in a horizontal direction to the workplace environment.
- One advantage of this cabinet is that **airflow parallel to the workplace cleanses the environment with a constant speed.**
- The air directly hits the operator, which might reduce the security level of this type of laminar flow cabinets.

Horizontal laminar flow cabinet

Principle/ Working of Laminar flow hood



- **The principle of laminar flow cabinet is based on the laminar flow of air through the cabinet.**
- **The air first passes through the filter pad or pre-filter that allows a streamline flow of air into the cabinet.**
- **Next, the blower or fan directs the air towards the HEPA filters.**
- **The HEPA filters then trap the bacteria, fungi and other particulate materials so that the air moving out of it is particulate-free air.**

- **Uses of Laminar flow hood**
- **The common uses of a laminar flow cabinet in the laboratory:**
- **1.For contamination sensitive processes like tissue culture.**
- **2.For media plate preparation and culture of organisms can be performed inside the cabinet.**
- **3.In the pharmaceutical industries, drug preparation techniques are also performed inside the cabinet to ensure a particulate-free environment during the operations.**
- **4.can also be used for general lab techniques in the microbiological as well as the industrial sectors**

Chemical Fume Hoods

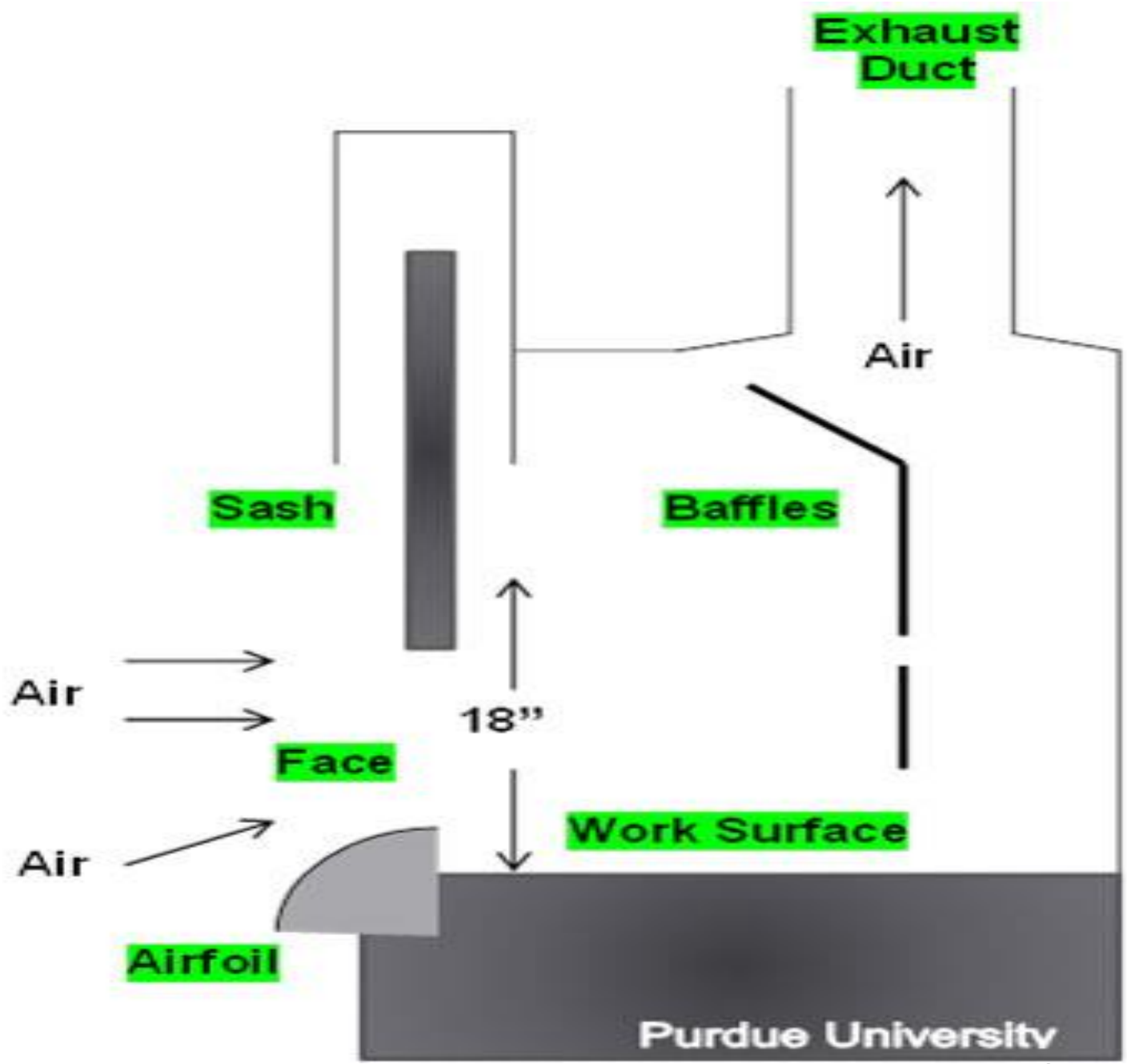
- • Ventilated enclosure
- • Protects personnel from chemical hazards
- • Captures, contains and exhausts vapors, gases, fumes and particulates
- • Physical barrier from chemical splashes and violent chemical reactions
- • Does not provide: - Environmental protection - Product protection
- • Are not used for work with regulated infectious agents

- **The laboratory chemical fume hood is the most common local exhaust ventilation system used in laboratories and is the primary method used to control inhalation exposures to hazardous substances.**
- **fume hoods offer a significant degree of protection for the user, It is prevent the release of hazardous substances into the general laboratory space by controlling and then exhausting hazardous**
- **In the event of an accidental spill, the fume hood will contain the spilled chemicals and exhaust the fumes away from the user and laboratory .**

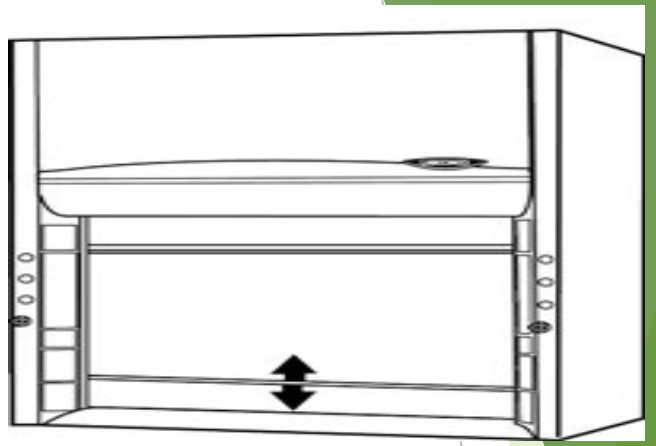
Parts of Fume Hood

- • **Hood Body:** The visible part of the fume hood that serves to contain hazardous gases and vapors.
- • **Baffles:** Moveable partitions used to create slotted openings along the back of the hood body. Baffles keep the airflow uniform across the hood opening, thus eliminating dead spots and optimizing capture efficiency.
- • **Sash:** By using the sash to adjust the front opening, airflow across the hood can be adjusted to the point where capture of contaminants is maximized. Each hood is marked with the optimum sash configuration. The sash should be held in this position when work involving the fume hood is being performed and closed completely when the hood is not in use.
- • **Airfoil:** Found along the bottom and side edges, airfoils simplify airflow into the hood

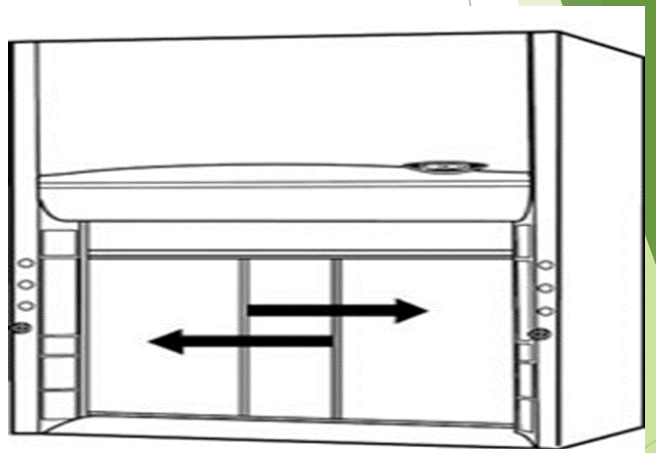
- • **Work surface:** Generally a bench top, or the floor in the case of a floor-mounted or walk-in hood, this is the area under the hood where work is conducted or apparatus is placed for use.
- • **Exhaust plenum:** An important engineering feature, the exhaust plenum helps to distribute airflow evenly across the hood face. Materials such as paper towels drawn into the plenum can create turbulence in this part of the hood, resulting in areas of poor airflow and uneven performance.
- • **Face:** The imaginary plane running between the bottom of the sash to the work surface.


Exhaust Duct
Air
Sash
Baffles
Air
18”
Face
Air
Work Surface
Airfoil
Purdue University

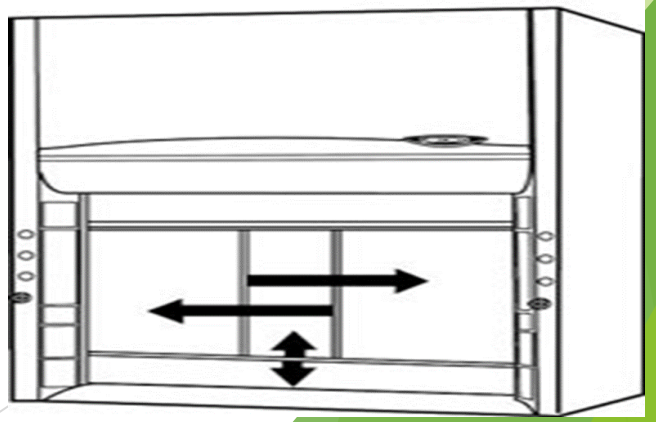
- **SASH OPENINGS**
- **Vertical:** The sash rises up and down and is optimal for shielding the user from contaminants with a large glass window pane



- **Horizontal:** The sash moves side to side and is comprised of multiple window panes. This gives the user more freedom to work in a certain area of the fume hood while reducing costs because the sash is never completely open.



- **Combination:** This is a sash designed with a horizontal pane system built into the vertical sash.

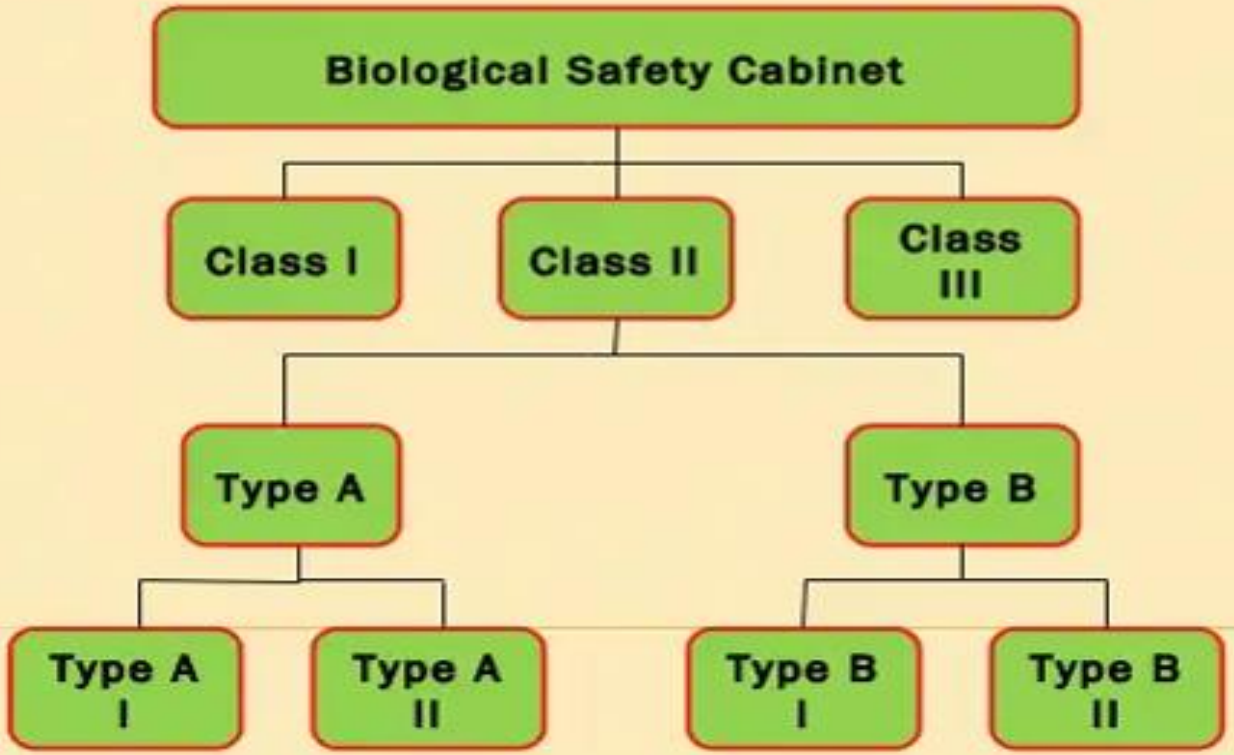


Biosafety cabinets (BSCs)

- **Biosafety Cabinets (BSCs) are enclosed workspaces with a ventilated hood that is designed to contain pathogenic microorganisms during microbiological processes.**
- **The primary purpose of biosafety cabinets is to protect the laboratory personnel and the environment from the pathogenic microorganism as aerosols might be formed during the processing of such microorganisms.**
- **Biosafety cabinets are only used for certain risk group organisms and for processes that might result in aerosol formation.**
- **These cabinets are provided with HEPA-filters that decontaminate the air moving out of the cabinet. All exhaust air is HEPA-filtered as it exits the biosafety cabinet, removing harmful bacteria and viruses.**
- **Biosafety cabinets might be confused with the laminar hood as both of these pieces of equipment work as enclosed workspaces (This is in contrast to a laminar flow clean bench, which blows unfiltered exhaust air towards the user and is not safe for work with pathogenic agents).**
- **laminar hood only provides protection to the sample and not to the personnel and the environment, whereas biosafety cabinets protect all three.**

- Neither are most BSCs safe for use as fume hoods, Likewise, a fume hood fails to provide the environmental protection that HEPA filtration in a BSC would provide
- However, most classes of BSCs have a secondary purpose to maintain the sterility of materials inside (the "product").
- The use of biosafety cabinets or other such physical containment is not required in the biosafety level 1 ,but depending on the risk assessment, some processes might require such containment.
- they minimize the formation of aerosol, protecting the environment, the pathogen, and the laboratory personnel.
- Besides, most BSCs also function to sterilize biological materials that are kept inside the cabinets.

Classification of Bio Safety Cabinet



- **Biosafety cabinets are classified into three classes I, II and III , each with specific performance characteristics and applications.**
- **Class I provides protection for the user and surrounding environment, but no protection for the sample being manipulated.**
- **Class II provides protection for the user, environment and sample, and is divided into five types: A1, A2, B1 ,and B2.**
- **Class I and II Biosafety cabinets are used for Biosafety levels I and II when used correctly in conjunction with useful microbiological techniques**
- **Class III BSCs are most suitable for work with hazardous agents that require Biosafety Level 3 or 4.**