



**STERILIZATION
&
DISINFECTION**

Sterilization

- o Sterilization
- o - Process by which an article, surface or medium is freed of all microorganisms either in vegetative or spore state.

Disinfection

o -Means destruction of all pathogenic microorganisms capable of giving rise to infection.

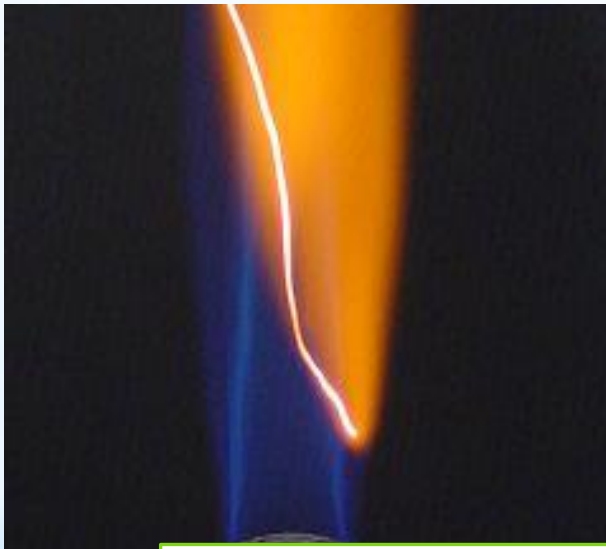
- **Disinfectant**

- A chemical used on nonvital objects to kill surface vegetative pathogenic organisms but not necessarily spore forms or viruses.

- **Antiseptic**

- A chemical that is applied to living tissues such as skin or mucous membrane to reduce the number of microorganisms present through inhibition of their activity or destruction.

*METHODS OF STERILIZATION



PHYSICAL AGENT



CHEMICAL AGENT

PHYSICAL AGENTS

1] SUNLIGHT

2] DRYING

3] DRY HEAT

4] MOIST HEAT


5] FILTRATION

6] RADIATION

7] ULTRASONIC & SONIC VIBRATIONS

DRY HEAT

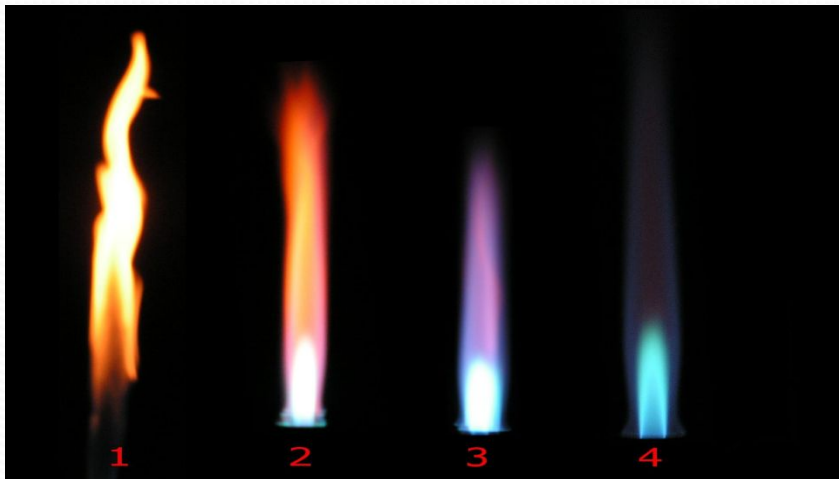
MECHANISM OF ACTION:-

- Protein Denaturation
 - Oxidative damage
 - Toxic effect of elevated level of electrolytes
- 

1] FLAMING

2] INCINERATION

3] HOT AIR OVEN



1) FLAMING

The articles are passed on the Bunsen flame.
articles are made **red hot**

- Articles Sterilized:
 - Inoculating loop of wires.
 - Forceps.
 - Spatulas.
 - Mouths of culture tubes.



2) INCINERATION

- Contaminated material in bulk is sterilized & disposed by burning in an incinerator.
- **Articles sterilized:**
 - surgical dressings
 - disposable syringes
 - contaminated lab materials
 - animal carcass
 - bedding.



Louis Pasteur discovered
in *1986*

Compartements with
perforated trays & fans

The temperature is

160c for 1 hour

Preserve sharp edges of
cutting instruments



**HOT AIR
OVEN**



Articles to be sterilized:-

- Scissors
- Scalpels
- Glass syringes
- Swabs
- Liquid paraffin
- Dusting powder
- Fats & Grease
- Glassware
- Forceps



*** Precaution to be taken when using a hot air oven:**

- **Temp. should not exceed 180c because glass ware kept inside will get a smoky appearance & paper wrapper used to cover the articles will get charred.**
- **The glassware kept inside should be totally dry or they will break.**
- **no sudden cooling of the hot air oven.**
- **no over loading of hot air oven.**

● STERILISATION CONTROL

- **BROWNE'S TUBE** use routinely.
- Green color indicates proper sterilisation
- Non-toxic strains of **CLOSTRIDIUM TETANI**
- Spores germination indicates improper sterilisation

GLASS BEAD STERILISER

Employs an heat transfer device

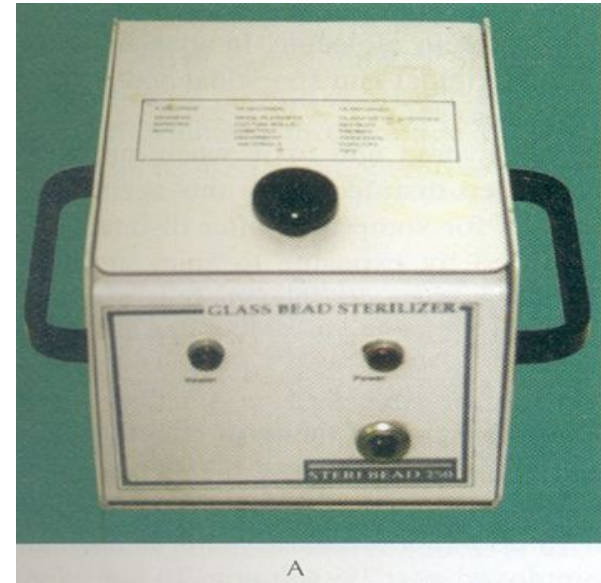
Glass beads & Salt

ARTICLES STERILISED:

Endodontic Files & Burs

Temperature is 220C

Time is 10 sec.



*MOIST HEAT

*MECHANISM OF ACTION:

- Denaturation of proteins
- Coagulation of proteins

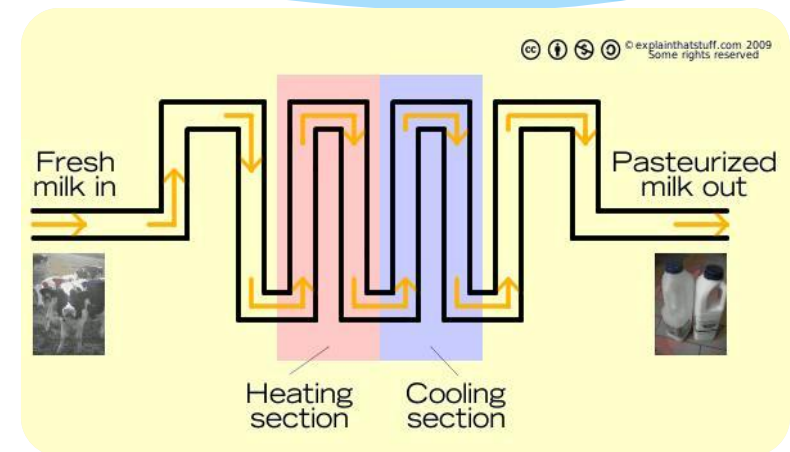
*TEMPERATURE BELOW 100C

*TEMPERATURE AT 100C



Pasteurization

- **Holder's process** (63C for 30 min)
- **Flash process** (72C for 15-20 sec)



- * Destroys - mycobacterium, salmonella & also Brucella.
- Coxiella burnetii survive Holder method.

o TEMPERATURE AT 100C

o (a) Boiling:

o Vegetative Bacteria killed at 90-100 min

o Time required is 10-30 min

o Not effective for Sporing Bacteria

o Sterilisation promoted by use of 2% Na bicarbonate



o **TYNDALLISATION –**

- o For media containing sugar or gelatin exposure of 100c for 20 min on 3 successive days

o (c) Steam under Pressure (AUTOCLAVE):

o Principle: Water boils when pressure equals to surrounding atmosphere.

o Saturated steam has penetrative power



- o In Downward displacement air in the chamber is forced downward and out of the bottom discharge outlet.
- o **Prevacuum high temperature** type
 - Most modern
 - Economical
 - least time to sterilize a single load.
- o Air is extracted from the chamber before admitting steam.

AUTOCLAVE TIME

<i>Temperature</i> (°Celsius)	<i>Pressure</i> (Lb)	<i>Time</i> (Minutes)
121	15	15
126	15	10
134	15	3

- **ARTICLES STERILISED:**

- Surgical Instruments
- Lab equipments
- Metallic syringes.
- *All culture media except media containing sugar & gelatin.*

STERILISATION CONTROL

- * Spores of **Bacillus stearothermophilus**
- * Autoclave tapes
- * Agents use to avoid corrosive action of steam :
 - Ammonia (Craford & Oldenburg)
 - 2% Na nitrite (Bertolotti & Hurst)
 - Dicyclohexylammonium nitrate (ADT)

*RADIATION

2 types

- Non ionizing radiation.
- Ionizing radiation.



A) Non Ionizing radiation

U. V. rays:

- Bring down the number of microorganism present in air.
- Sterilization of Operation Theaters and biological safety cabinets.

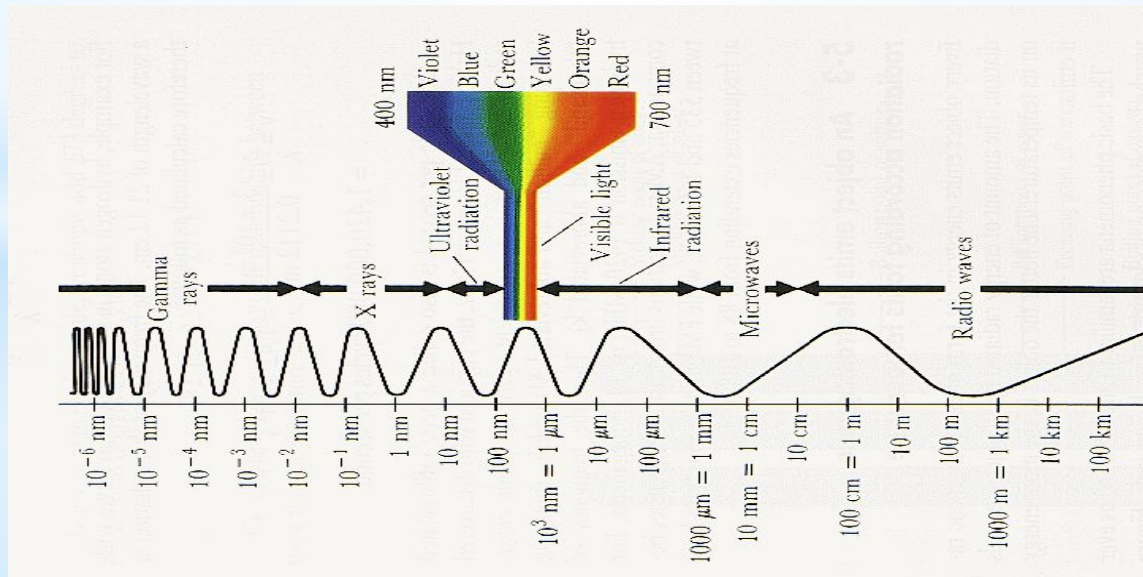
* Disadvantage: Low-penetrating power.



B) Ionizing Radiation:

'X'- rays ,gamma rays, cosmic rays.

- cold sterilization.
- very high penetrating power.
- lethal to DNA and other cell constituents
- effective for heat labile items



*FILTRATION

- Used to sterilize heat labile liquids like sera, sugar solutions.
- Bacteria free filtrate of Virus sample is obtained.
- TYPES:
 - (a)Candles filters
 - (b)Asbestos disc filters.
 - (c)Sintered glass filters
 - (d)Membrane filters.

*ULTRASONIC & SONIC VIBRATIONS

* No practical value in sterilisation & disinfection

* DENTAL EQUIPMENTS STERILISATION



EQUIPMENTS	METHOD OF STERILISATION
SURGICAL INSTRUMENTS	AUTOCLAVE
SHARP INSTRUMENTS	HOT AIR OVEN
OTHER MATERIALS	AUTOCLAVE
SYRINGES	IRRADIATION



CHEMICAL AGENTS

. The main modes of action are:

1) Protein coagulation.

2) Disruption of cell membrane

3) Removal of free sulphhydryl groups

4) Substrate competition for enzyme.

CHEMICAL AGENTS

- * ***Alcohols***
- * ***Aldehydes***
- * ***Dyes***
- * ***Halogens***
- * ***Phenols***
- * ***Gases***
- * ***Surface active agents***
- * ***Metallic salts***

GASES

Ethylene oxide

- * Highly penetrating gas
- * Highly inflammable.
- * Action is due to its alkylating the amino, carboxyl, hydroxyl, sulphhydryl groups in protein molecules

* Mixing with carbon dioxide or nitrogen 10% eliminates explosive tendency

* Mutagenic & carcinogenic

* ARTICLES STERILISED:

* --Heart-lung machine

* --Respirators

* --Sutures

* --Dental equipments

* --Glass, metal & paper surface



Formaldehyde gas

- * Fumigation of operation theatres and other rooms.
- * After sealing the windows and other outlets, formaldehyde gas is generated by adding *150 gms of KMNO₄ to 280 ml formalin for every 1000cu. Ft of room volume.*
- * *Doors open after 48 hrs*

BETAPROPIOLACTONE

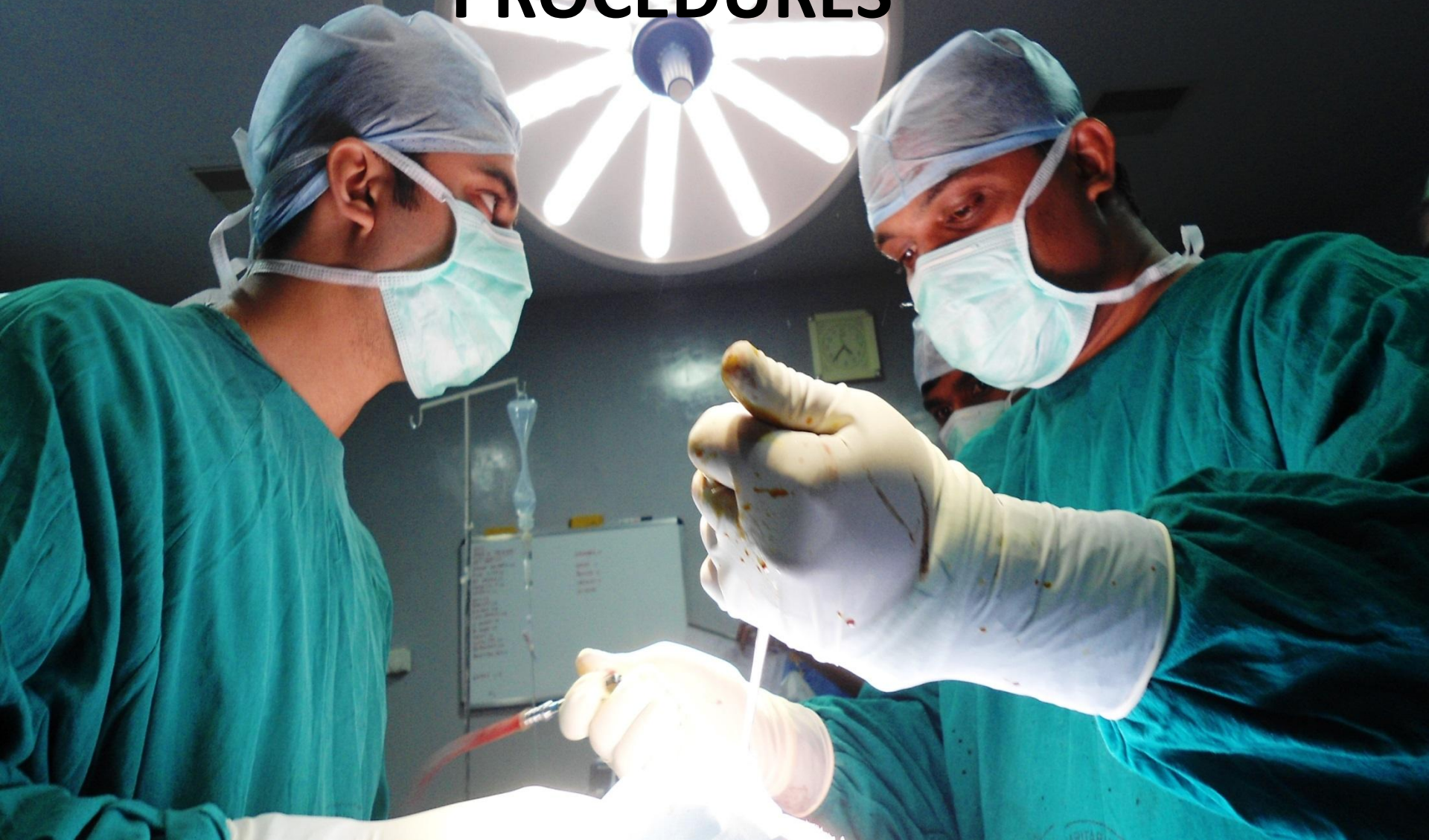
- * Condensation product of ketane & formaldehyde
- * Low penetrating power
- * More efficient for fumigation than formaldehyde
- * Very active against viruses
- * Has carcinogenic activity

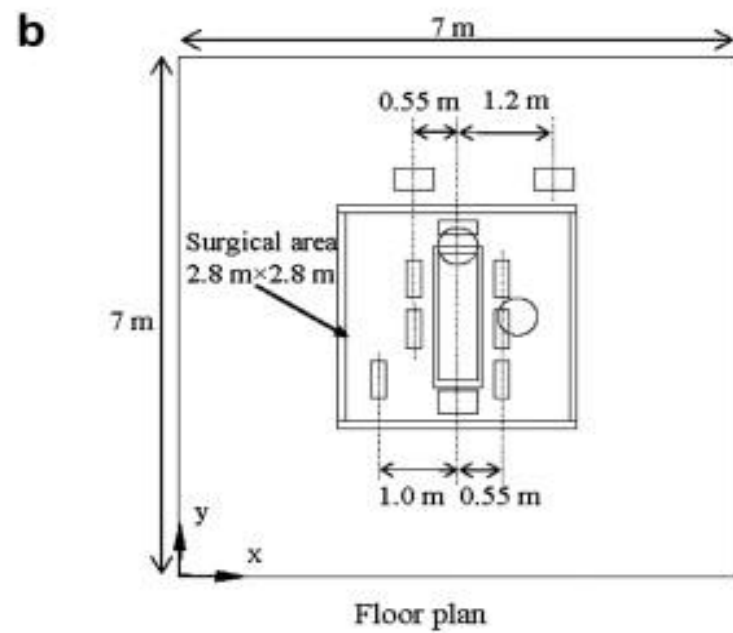
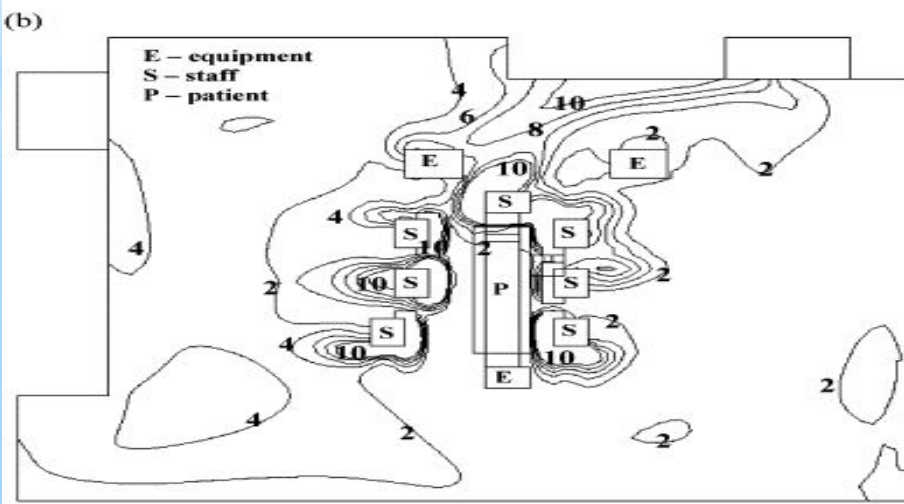
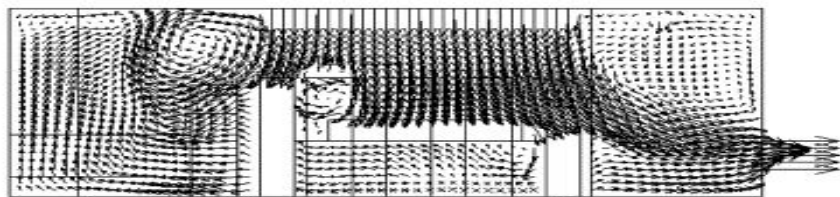
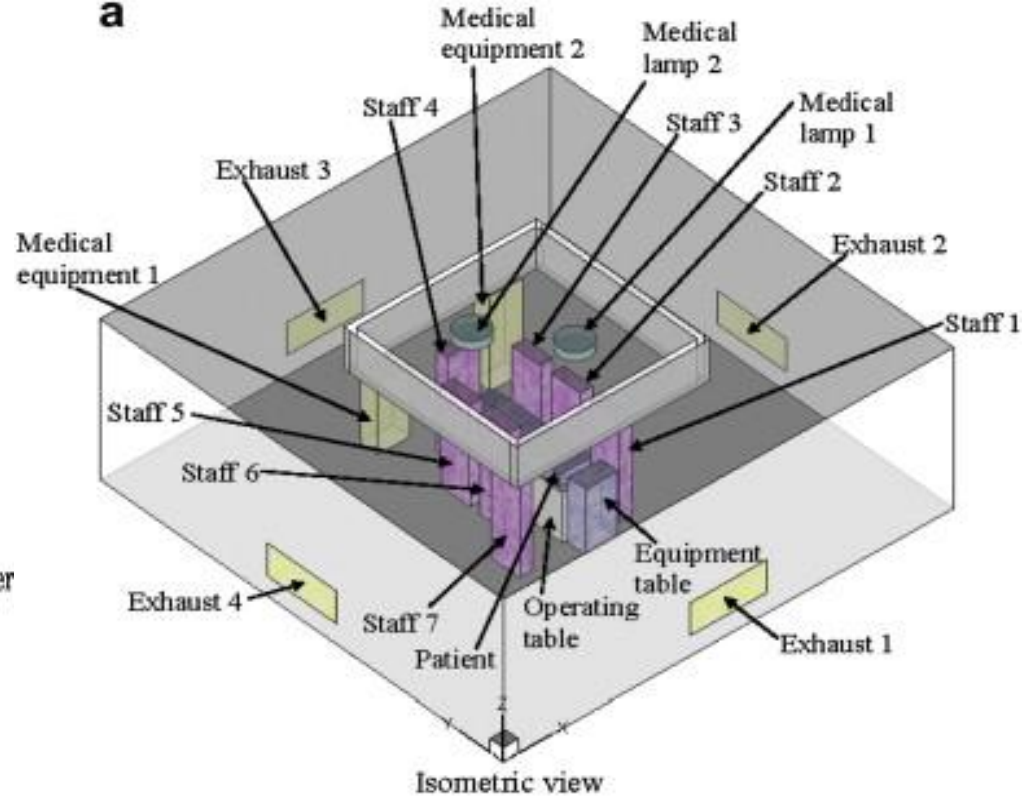
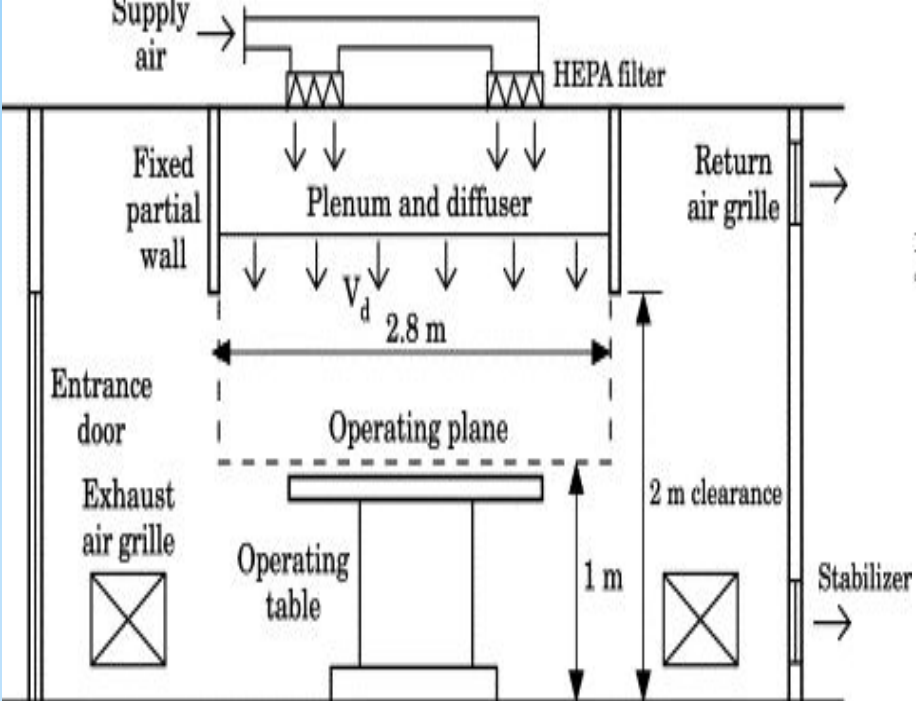


SURFACE ACTIVE AGENTS

- * Alter energy relationship at interface leads to reduction of interfacial tension
- * Classified as:
 - * -Cationic
 - * -Anionic
 - * -Nonionic
 - * -Amphoteric

OPERATING ROOM PROCEDURES



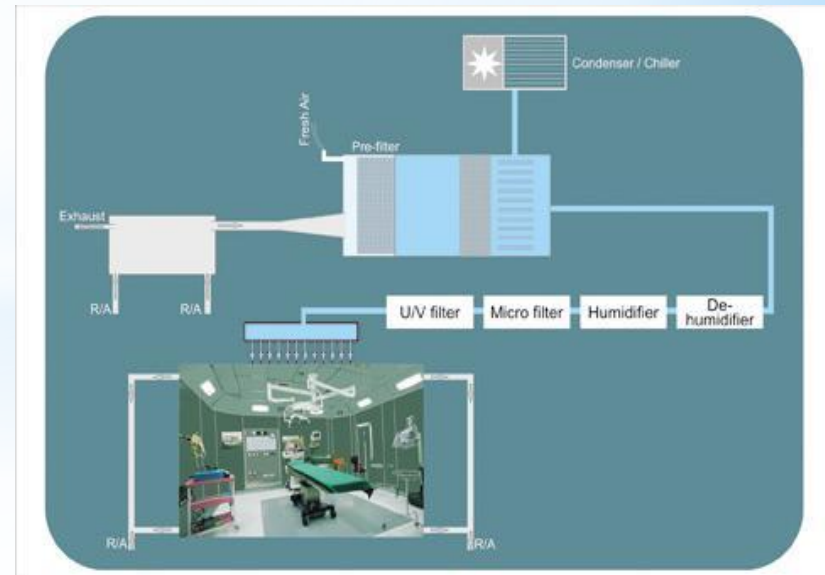
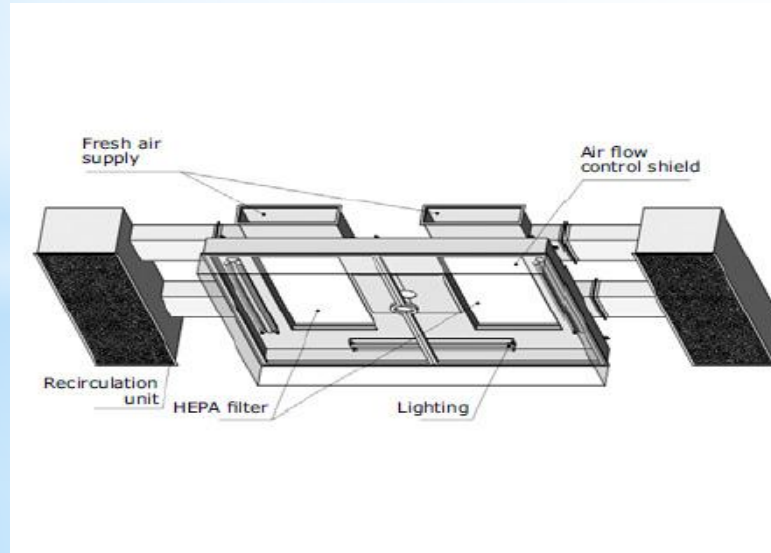


Ideal theatre should have:

- * Pressure release dampers
- * Ceiling solid
- * Minimum fixtures , shelves
- * Doors should be closed properly
- * Windows should be sealed properly
- * Flooring should have no gaps
- * Walls preferably rounded

*** THEATRE INTERIOR**

*The operating theatre ceiling is the most important part of a hospital ventilation system. Also called UCVS (Ultra Clean Ventilation System), these sophisticated systems are actually a combination of air filter housings or filter grids, HEPA filters, priming illumination and air diffusers



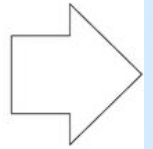
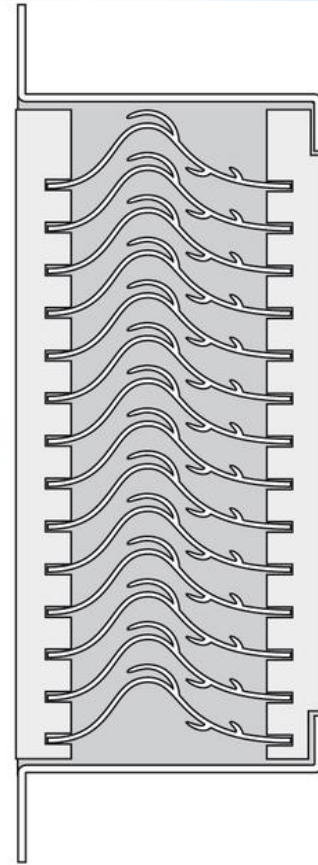


* AIR FILTRATION

- * extracts dust, powder and smoke for inbound air



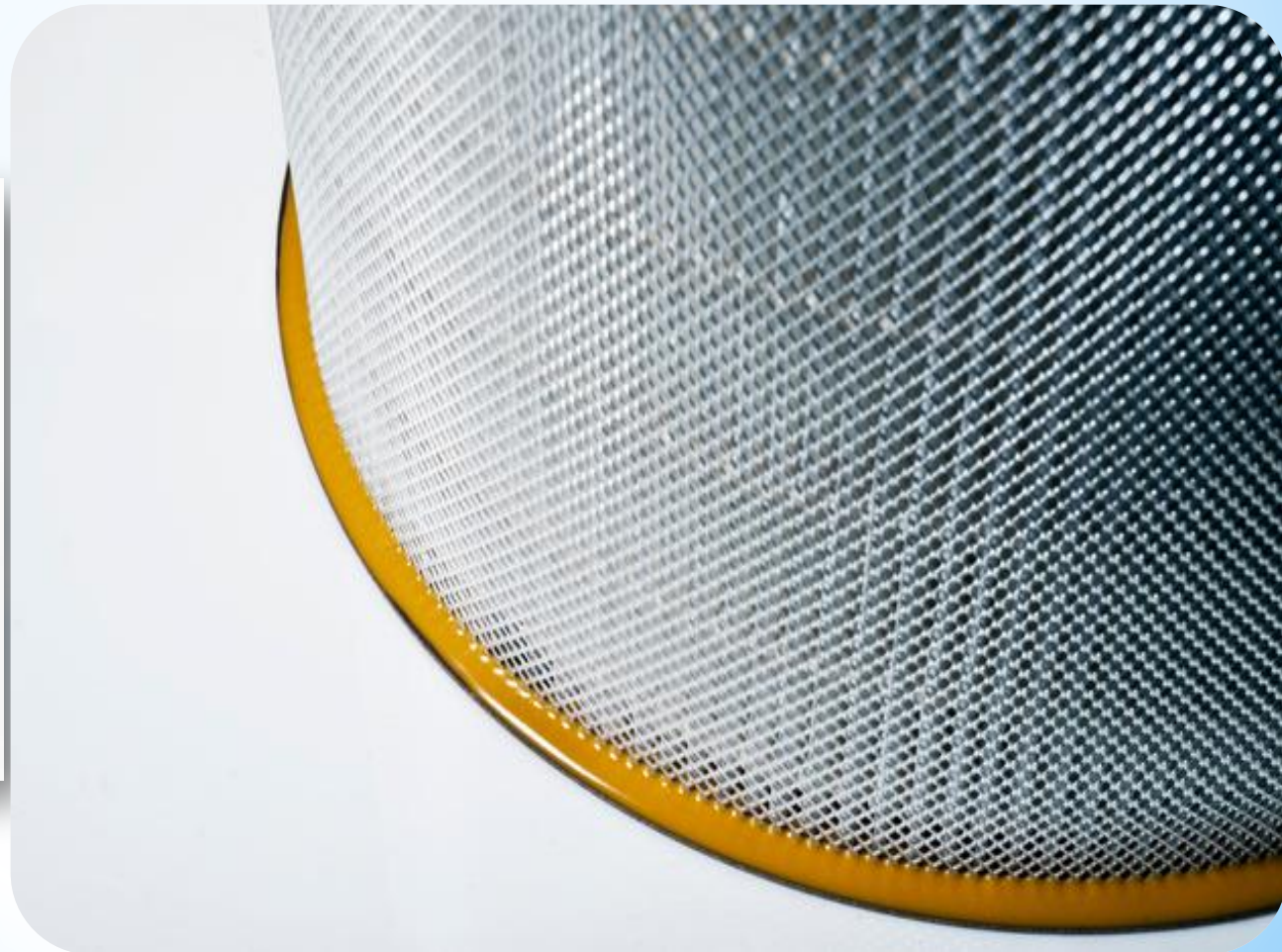
* **Dust collector**



***dehumidifier**

*EPA FILTER

- * designed to separate particles such as bacteria, viruses or general contaminants suspended in air,



* HEPA FILTER

* air filter designed to filter submicron, airborne particulate contamination.

(high efficiency particulate filter)

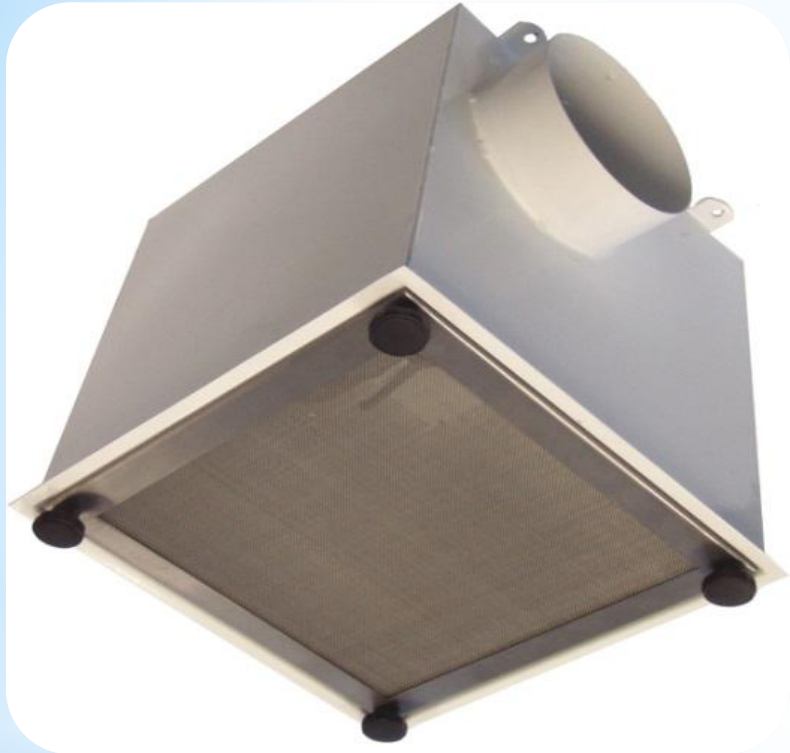




ULPA FILTER

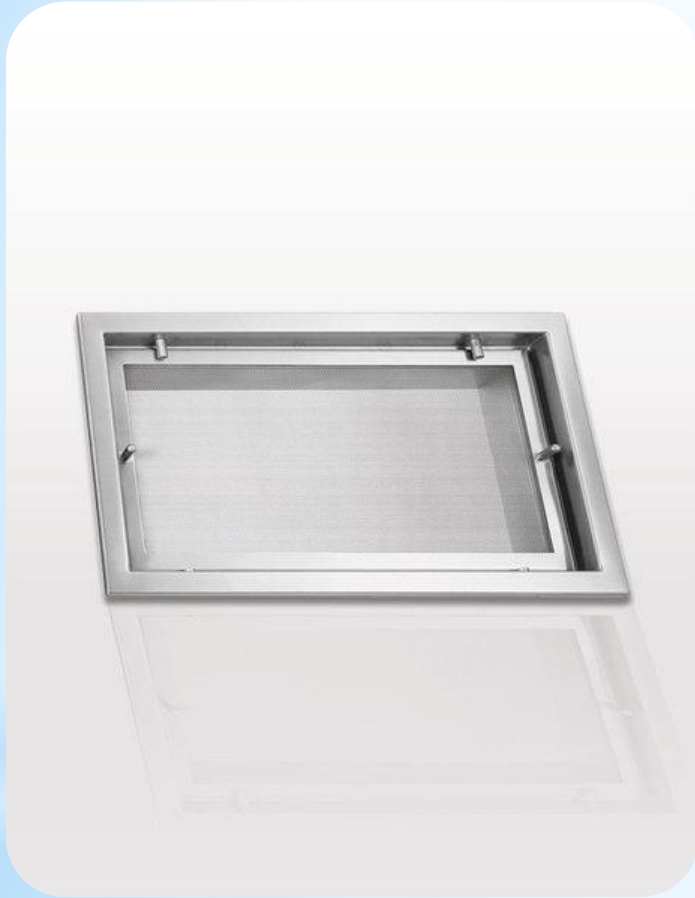
face velocities up to **3 m/s** (air volumes up to **4000 m³/h**)
designed for the separation of suspended matter in supply and exhaust air
systems
ultra low pressure air

* Air filter housing



- * . Viruses, bacteria and dust particles are filtered out of the airstream immediately before the air outlet,
- * eliminates the risk OF cross contamination in the ventilation ducts.

* FLUFF SEPERATOR



- * Installed in exhaust air ducts,
- * provide efficient filtration of clothing and other textile fibres,



Antisept

Antisept

* EXHAUST GRILLE

*The return air should be picked up/ taken out from the exhaust grille located near the floor level (approx 6 inches above the floor level)

**National Accreditation Board for Hospitals and Healthcare Providers*

- Superspeciality OT
- general OT

* OT Size: Standard OT size of 20' x 20' x 10'

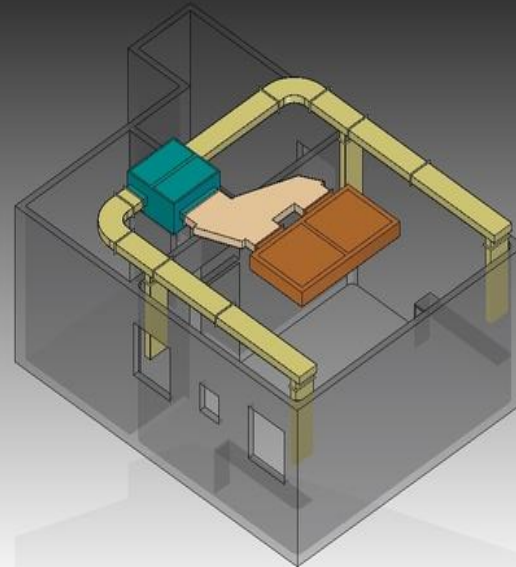
* Occupancy: Standard occupancy of 5-8 persons at any given point

*** The Revised Guidelines for AirConditioning in Operation Theatres**

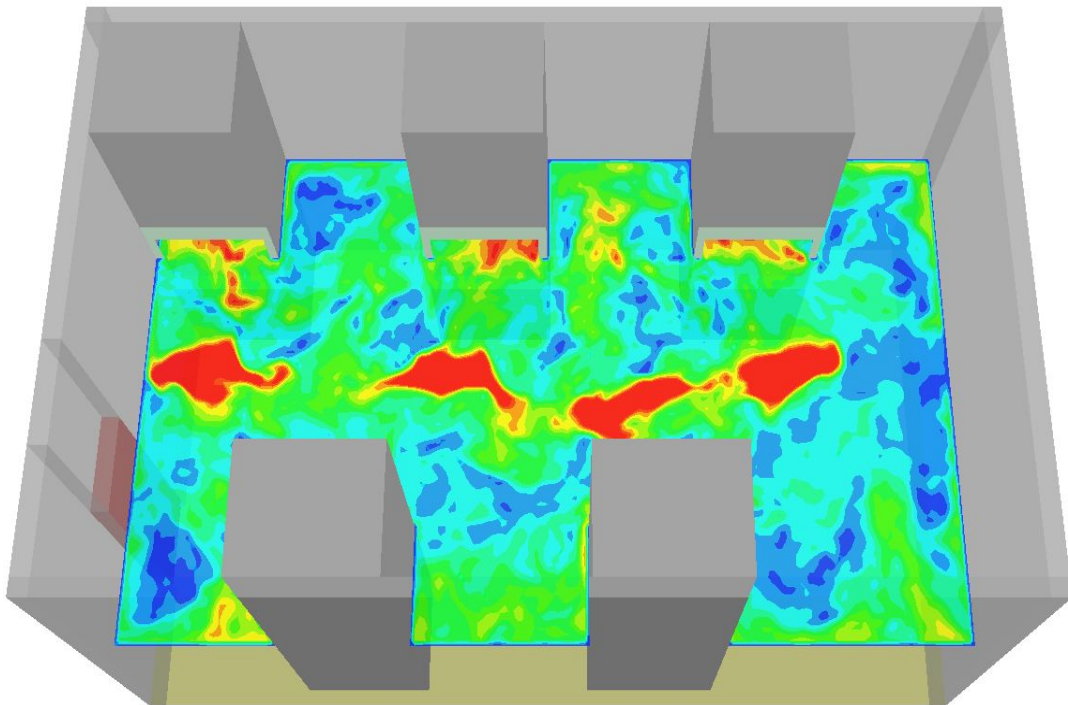
* REQUIREMENTS

I. Air Change Per Hour:

- * □ Minimum total air changes should be 25
- * □ The fresh air component of the air change is required to be minimum 4 air changes out of total minimum 25 air changes



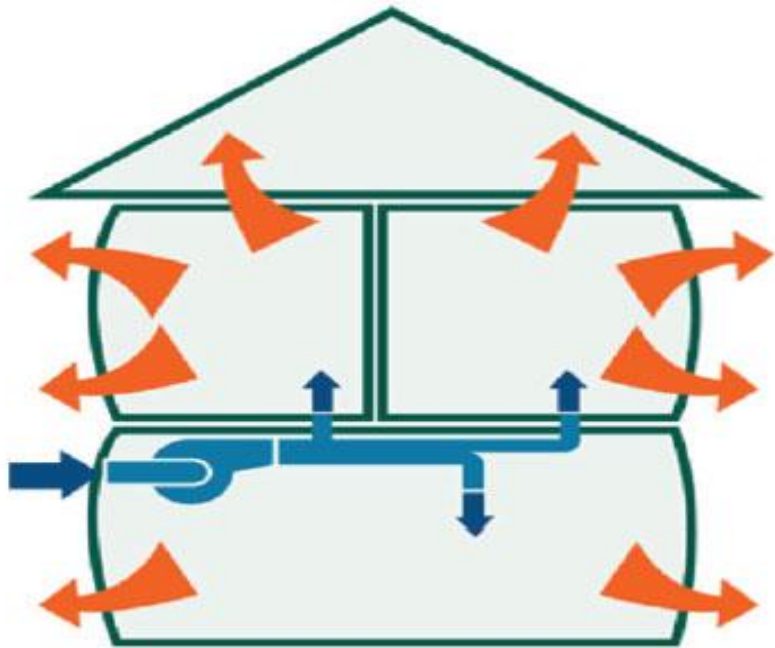
- * II. Air Velocity: The vertical down flow of air coming out of the diffusers should be able to carry bacteria carrying particle load away from the operating table. The airflow needs to be unidirectional and downwards on the OT table.



* **AIR VELOCITY**

* III. Positive Pressure: There is a requirement to maintain positive pressure differential between OT and adjoining areas to prevent outside air entry into OT.

* The minimum positive pressure recommended is 15 Pascal (0.05 inches of water)



* **POSITIVE PRESSURE**

*Air Filtration: The air quality at the supply i.e. at grille level should be Class 1000/ ISO Class 6 (at rest condition). Class 1000 means a cubic foot of air must have no more than 1000 particles pre filters of capacity 10 microns and 5 microns with aluminum/ SS 304 frame

HEPA filters of efficiency

99.97% down to 0.3 microns or higher efficiency

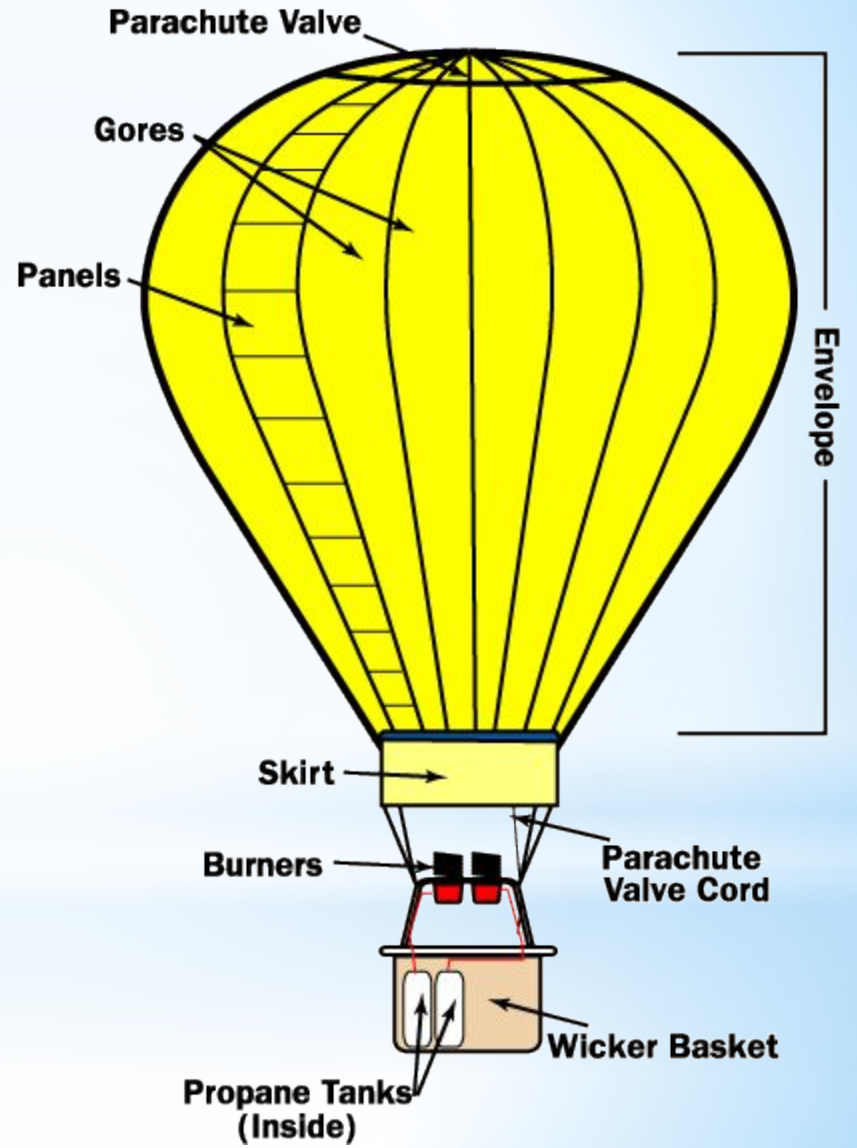
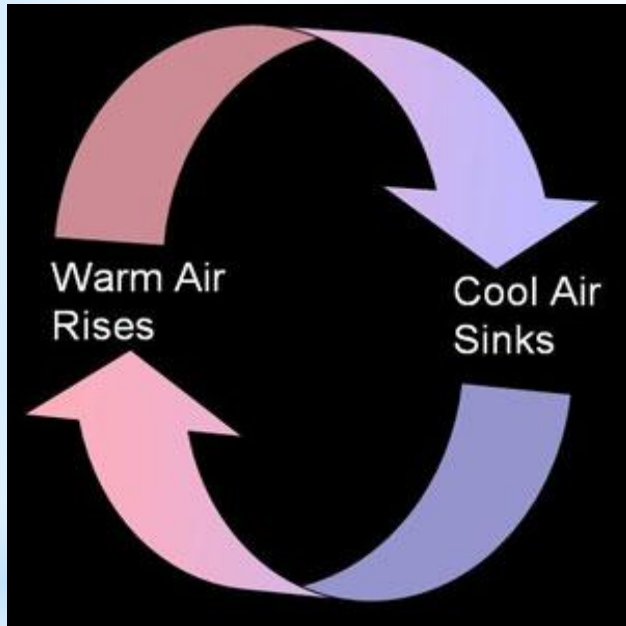
may be provided in the AHU

*** AIR QUALITY**

- * V. The temperature should be maintained at 21 ± 3 Deg C inside the OT all the time
- * corresponding relative humidity between 40 to 60% though the ideal is considered to be 55%.
- * Appropriate devices to monitor and display these conditions in the OT should be present



***Temperature &
Humidity**



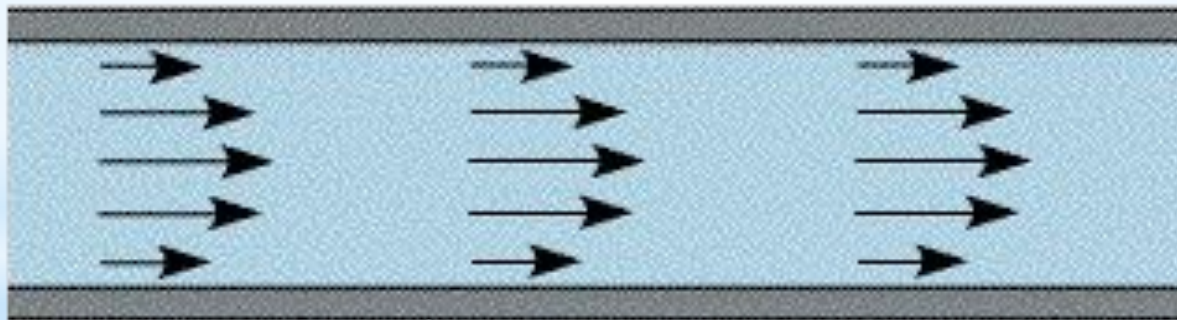
*A continuous progression through zones that increasingly approach sterility, was called for from the entrance to the suite to the operating and sterilizing rooms. Two common ventilation methods—‘**turbulent**’ and ‘**displacement**’ ventilation—were named.



Turbulent

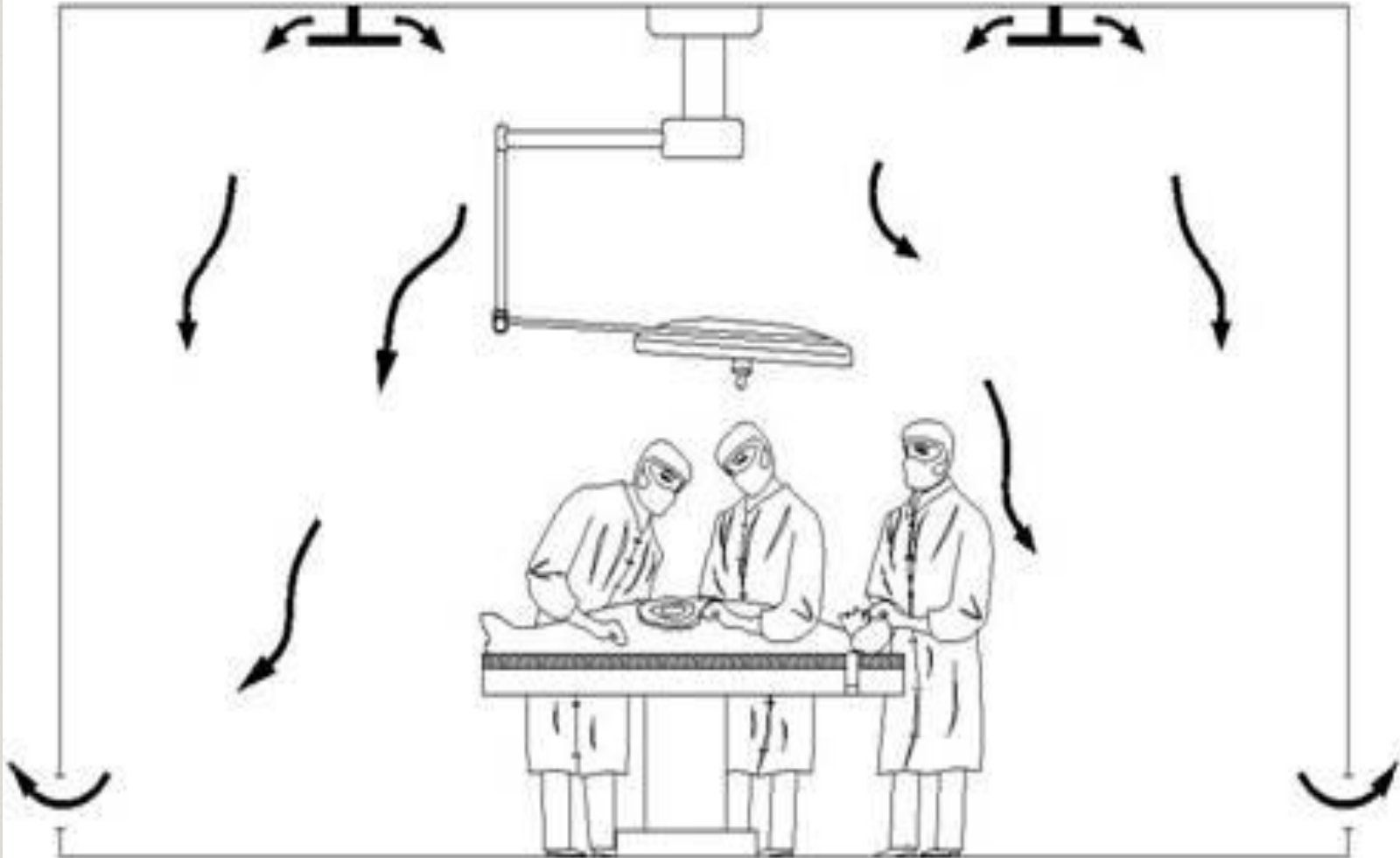


Laminar



turbulent ventilation

- o In turbulent ventilation, the supply air through high-level grilles was arranged to produce ***air turbulence throughout the room,***
- o velocity of **0.2 m/s (40 ft/min)** at the centre of the room. Bacteria liberated close to the operating table were rapidly dispersed and the reasonably vigorous air movement provided a comfortable environment even at high temperatures and humidity.
- o The identified disadvantage of this was the ***possible transportation of microbes*** liberated near the floor or at the periphery of the room into the operation zone.



* *Laminar flow* ventilation was first pioneered by *Charnley* in the 1960s and 1970s

* *Laminar type use in modern operation theatres*

* **AIR CHANGE RATE:**

* -Conventional maintains at rate of 20 air changes per hour

* -Laminar maintains at rate of 300 air changes per hour

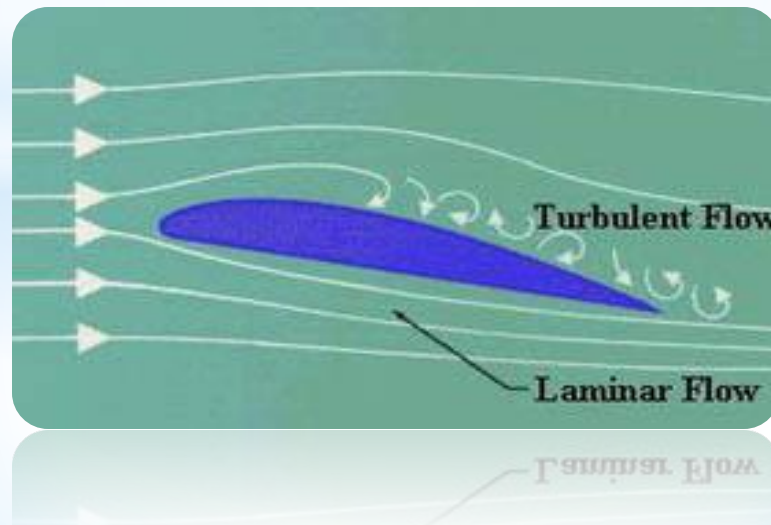


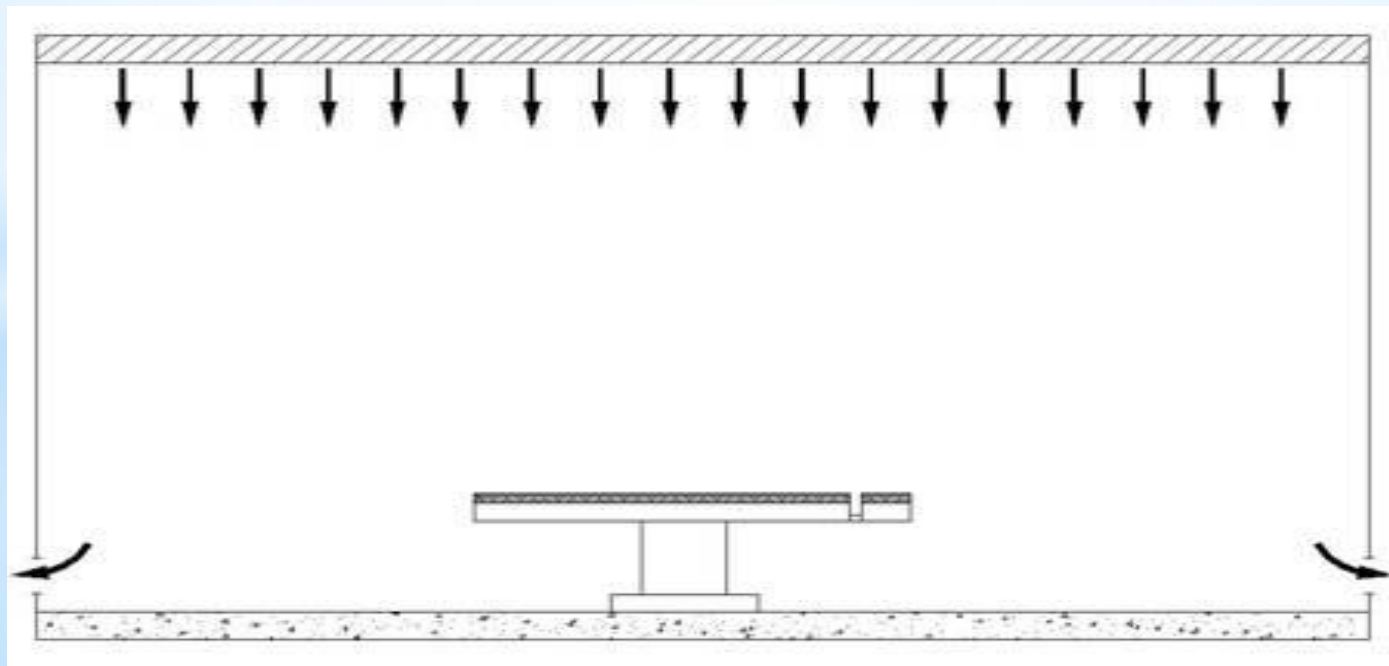
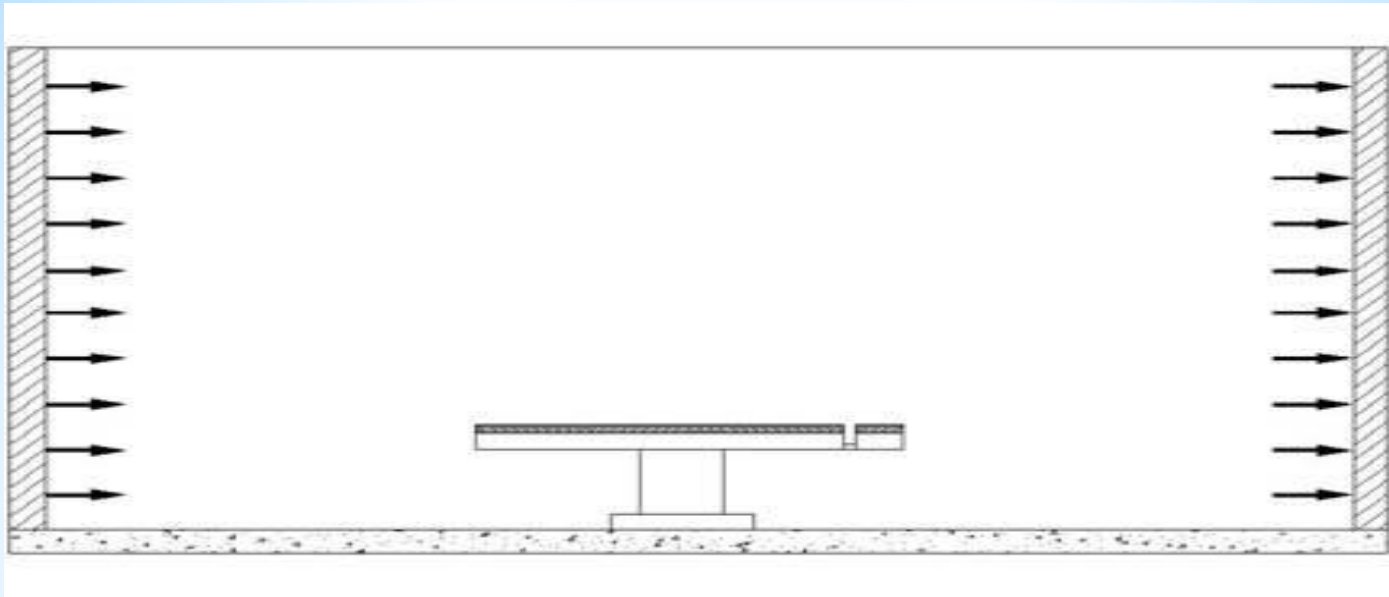
* **John Charnley**

* LAMINAR FLOW

- * The laminar airflow (LAF) of operating theatres is not a strictly accurate description, as it does not fulfil the aerodynamic conditions for genuine laminar flow.
- * The advantage of using LAF over the turbulent counterpart is its ability to minimize infection by mobilizing a relatively uniform and large volume flow of clean air.
- * After passing through the three stages of filtration (with a HEPA filter as the final stage), the conditioned air enters the OT through a large supply diffuser that occupies a substantial wall or ceiling area and moves towards the surgical area making only a single transit. When the room air moves in a single direction at a velocity of 0.46 m/s (90 ft/min)

- * convection currents due to heat or movement are abolished and the re-entrainments of particles into the operative field are stopped. When a solid object is encountered, the air flows round the object and the laminar-flow pattern is distorted only in the immediate surroundings of the object. Contaminants are flushed out as soon as they are liberated without migration to other areas.
- * Purpose-built LAF rooms have two main configurations: **vertical flow and horizontal flow.**

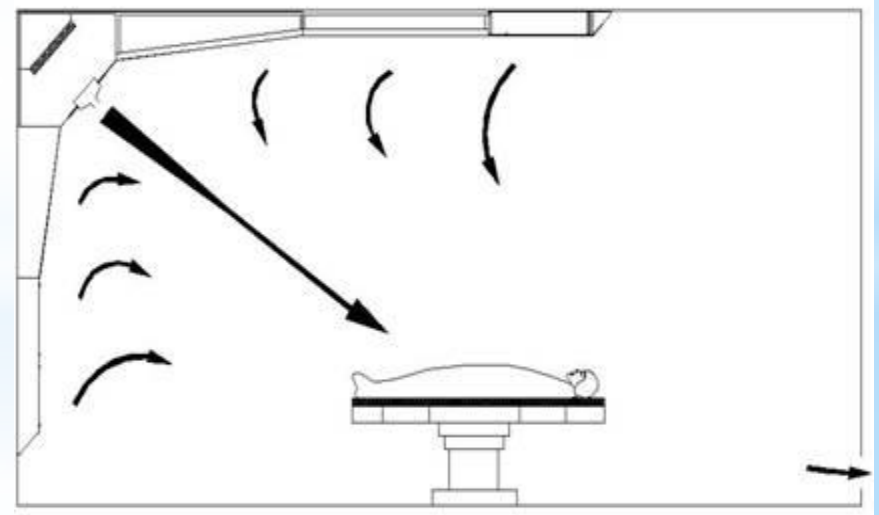
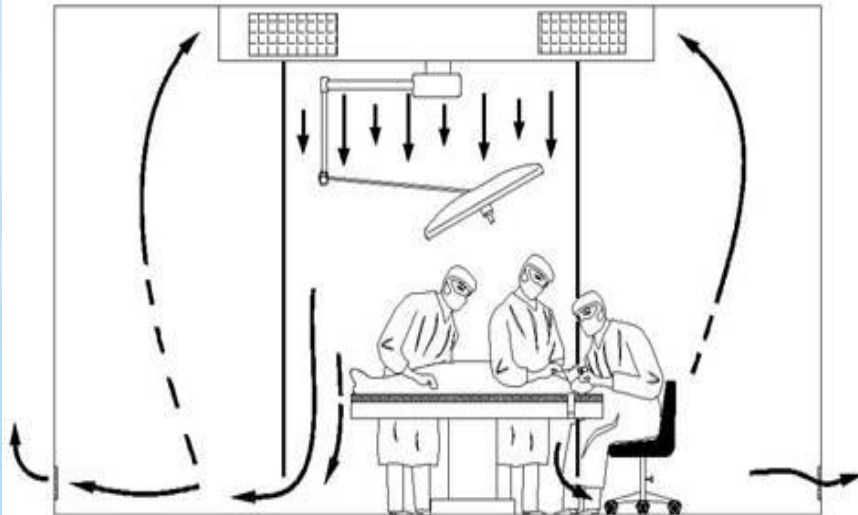


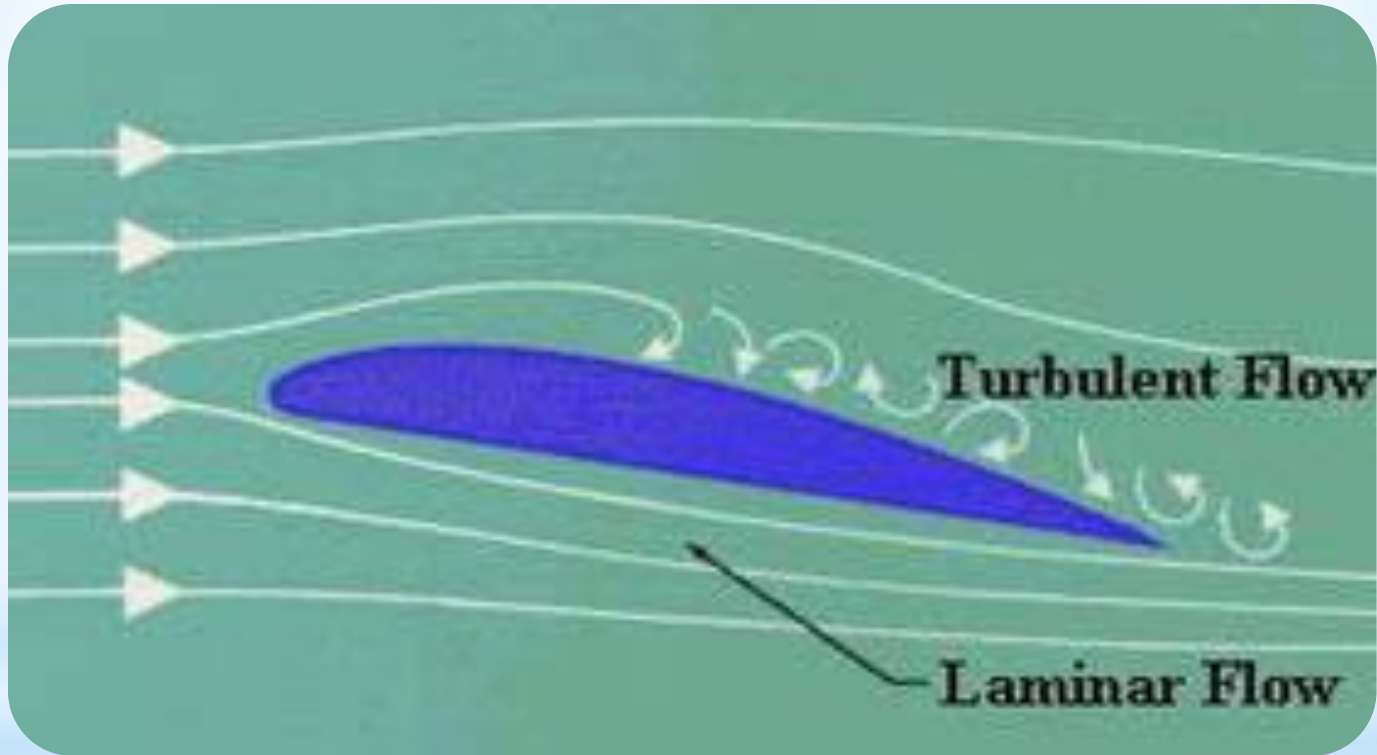


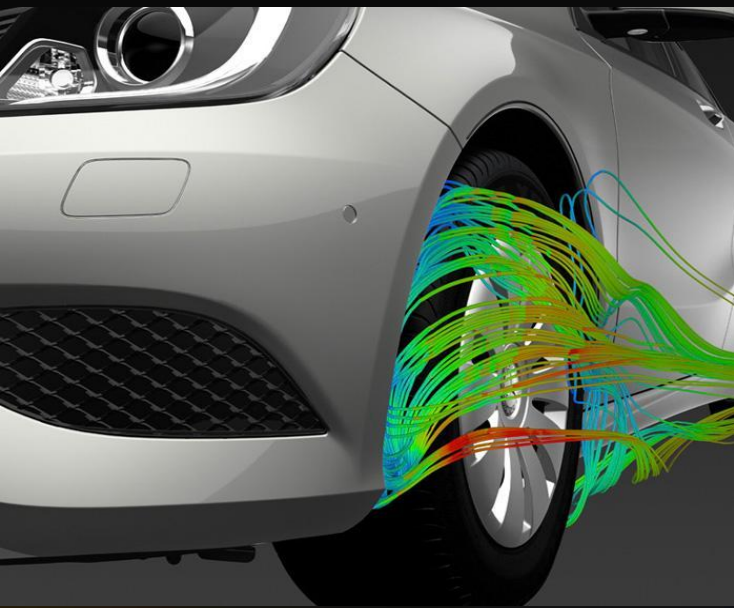
*COLONY FORMING UNITS:

*-Conventional has 150-300cfu/m

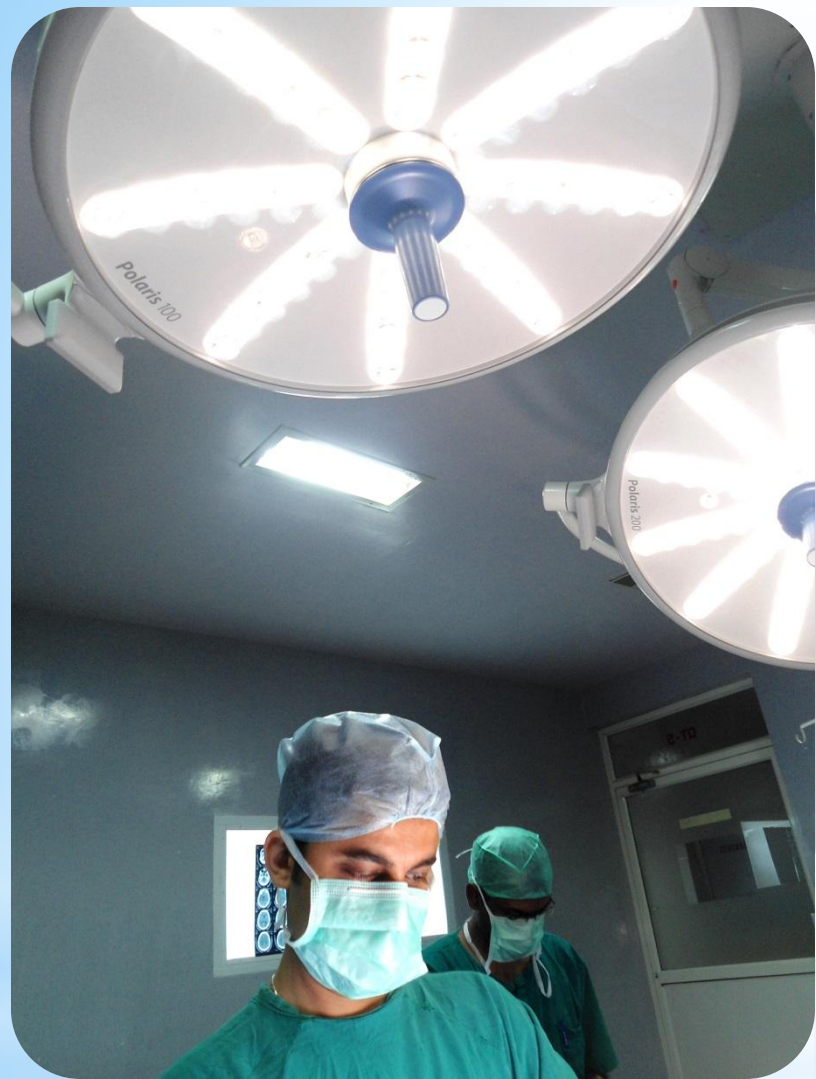
*-Laminar has 10cfu/m











Effects of Operating Lights on Laminar Airflow.flv

* FUMIGATION

* Fumigation achieved by use of formaldehyde and potassium permanganate reaction technique

* Higher the relative humidity better the disinfectant



* Formaldehyde level is about 280ml with 150 gms of KMnO_4 use for room of size 1000 cubic feet

PRE OPERATIVE PATIENT PREPARATION



- * Preoperative showering with hexachlorophene has shown reduction in wound infection.
- * Short preoperative hospital stay reduces pathogenic bacteria on skin and nasal carrier state.



***SHAVING THE
SURGICAL AREA**

- * shaving a patient's skin before surgery may raise the risk of an infection.
- * In its guidelines for preventing surgical site infections, the Centre for Disease Control recommends that hair not be removed unless it will interfere with the operation. When shaving is necessary, electrical clippers should be used.
- * strong evidence to recommend that when hair removal is considered necessary, shaving should not be performed. Instead a depilatory or electric clipping, preferably immediately before surgery, should be used. AORN J 75 (May 2002) 928-940.
- * shaving with a razor blade causes microscopic nicks in the skin that can become bacterial breeding grounds.
- * patients with shaved incision sites had a 5.6 percent rate of infection, compared with a rate of less than 1 percent among patients whose hair was removed with clippers.

* Pre-operative hair removal

- * The iodophors (e.g., povidone-iodine), alcohol-containing products, and chlorhexidine gluconate are the most commonly used agents.
- * Alcohol is readily available, inexpensive, and remains the most effective and rapid-acting skin antiseptic. Aqueous 70% to 92% alcohol solutions have germicidal activity

* Patient skin preparation

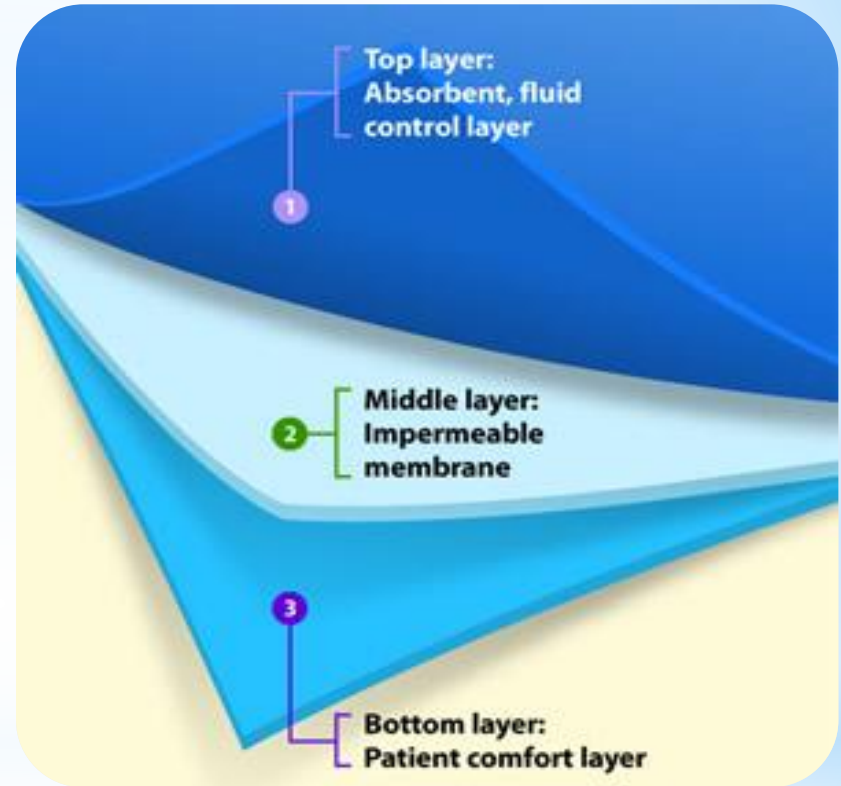
SKIN PREPARATION

Name	Presentation	Uses	Comments
Chlorhexidine (Hibiscrub)	Alcoholic 0.5% Aqueous 4%	Skin preparation Surgical scrub in dilute solutions in open wounds	Has cumulative effect. Effective against Gram-positive organisms and relatively stable in presence of pus and body fluids
Povidone-iodine (Betadine)	Alcoholic 10% Aqueous 7.5%	Skin preparation Surgical scrub in dilute solutions in open wounds	Safe, fast-acting broad spectrum. Some sporicidal activity. Antifungal.
Cetrimide (Savlon)	Aqueous	Hand washing Instrument and surface cleaning	<i>Pseudomonas</i> spp. may grow in stored contaminated solution
Alcohols Hypochlorites	70% ethyl, isopropyl Aqueous preparations	Skin preparation Instrument and surface cleaning.	Should be reserved for use as disinfectant
Hexachlorophen e	Aqueous bisphenol	Skin preparation Hand washing	Has action against Gram-negative organisms

- * Before the skin preparation of a patient is initiated, the skin should be free of gross contamination (i.e., dirt, soil, or any other debris)
- * The patient's skin is prepared by applying an antiseptic in concentric circles, beginning in the area of the proposed incision
- * The prepared area should be large enough to extend the incision or create new incisions or drain sites



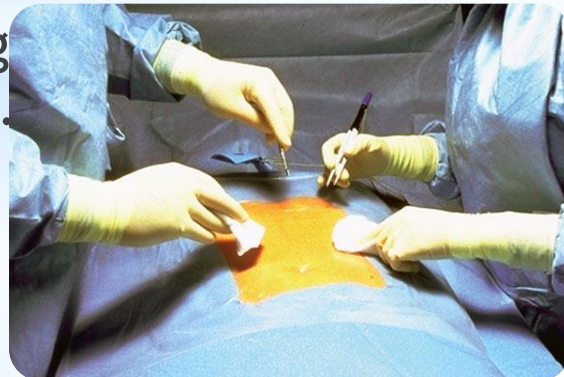
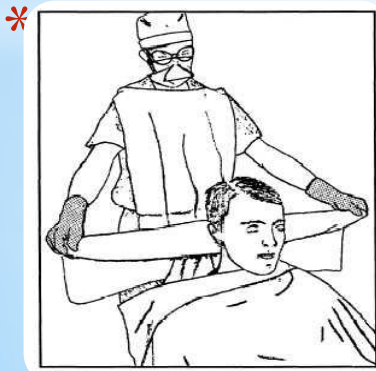
* **METHOD**



* DRAPING THE PATIENT

Sterile surgical team members must not come into contact with contaminated undersurface of the drape that has come into contact with a nonsterile surface.

- * Once a drape has been positioned, it should not be repositioned. The top of furniture, such as the O.R. table, back table and prep table are considered sterile, and the portion of the drape hanging below the edge is considered nonsterile.
- * The surgeon should maintain 12" away from the O.R. table when performing the draping procedure
- * surgeon should not reach across an undraped O.R. table in order to perform a draping procedure.

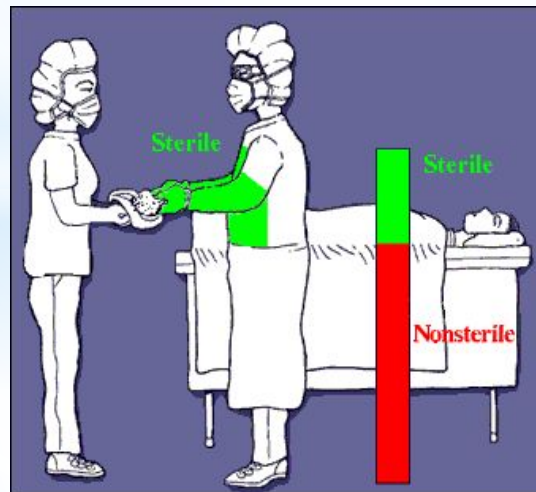


used to keep towels or

Standard practice

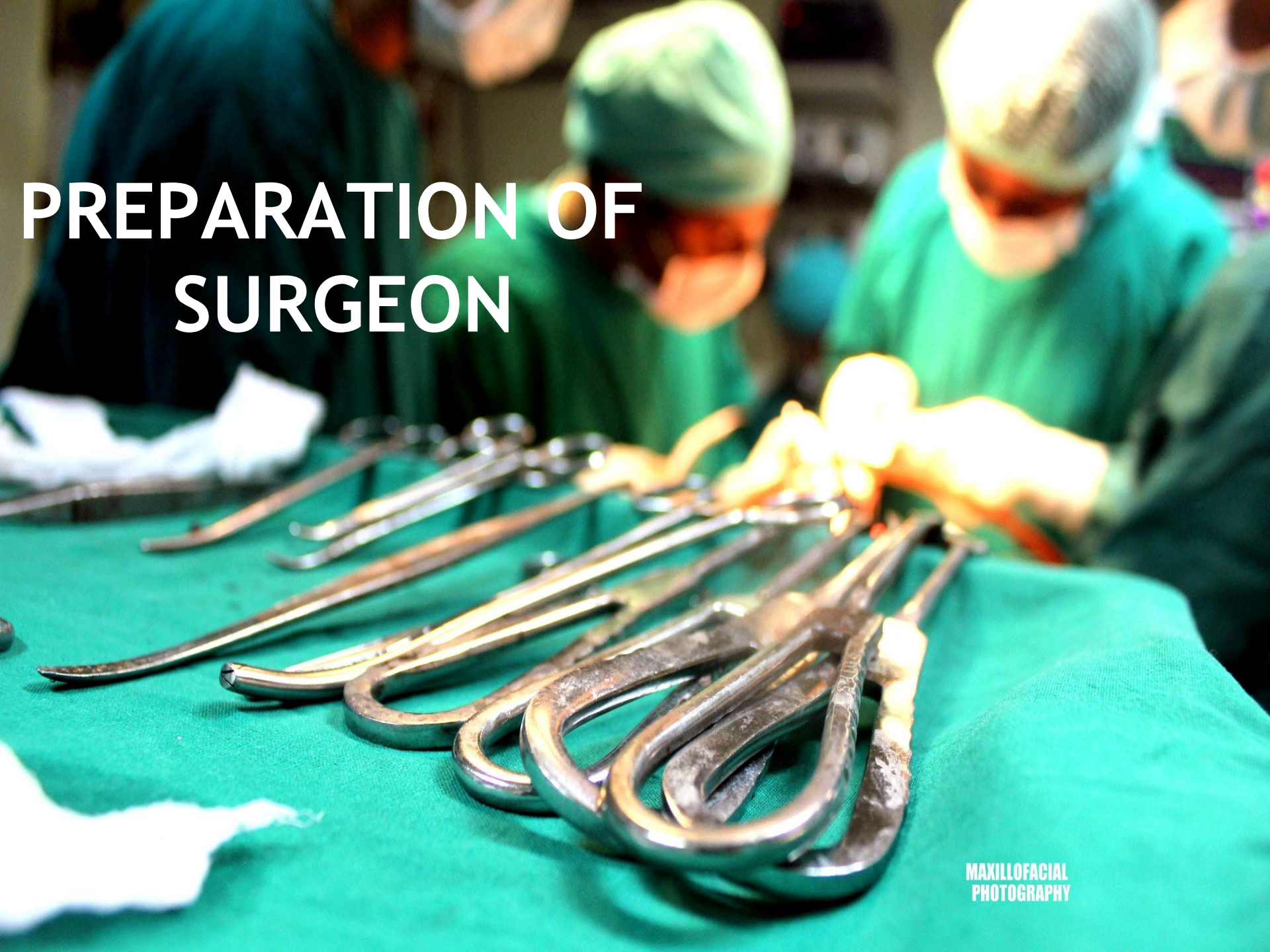
*Beckhaus towel clip

*Pinchter type towel clip



*Towel clips

PREPARATION OF SURGEON






* PRE-OPERATIVE HAND SCRUB

- * Povidone-iodine and chlorhexidine gluconate are the current agents of choice
- * Recent studies suggest that scrubbing for at least 2 minutes is as effective as the traditional 10-minute scrub in reducing hand bacterial colony counts, but the optimum duration of scrubbing is not known



- * **Dunphey & Way** recommends 10 min for scrubbing technique
- * Hexachlorophene compounds
- * Povidone iodine 7.5%
- * 2.5% Chlorhexidine in 70% alcohol
- * In some comparisons of the two antiseptics when used as preoperative hand scrubs, chlorhexidine gluconate achieved greater reductions in skin microflora than did povidone-iodine and also had greater residual activity after a single application



-  Areas most frequently missed during hand washing
-  Less frequently missed
-  Not missed

(Adapted from Taylor L (1978), An evaluation of hand washing techniques - I, Nursing Times, 12 January, pp 54-55)



Step 1 - Apply cleaning agent and rub briskly using a circular motion. Create a lather.



Step 2 - Interlace the fingers and rub briskly.



Step 3 - Do the back of each hand.



Step 4 - Use a 'monkey grip' and rub briskly



Step 5 - Rotational rub of right thumb and vice versa.



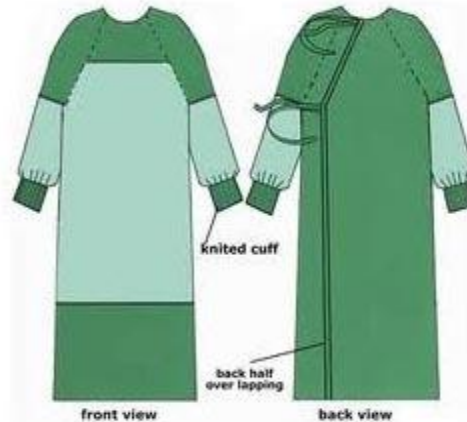
Step 6 - Rub backwards and forwards with tops of fingers in the palms of your hands.

- * The first scrub of the day should include a thorough cleaning underneath fingernails usually with a brush.
- * After performing the surgical scrub, hands should be kept up and away from the body (elbows in flexed position) so that water runs from the tips of the fingers toward the elbows.
- * Sterile towels should be used for drying the hands and forearms before the donning of a sterile gown and gloves.



SURGICAL GOWNS

- **Materials:**
 - **Polypropylene**
 - **Polyethylene**
 - **Polyester**
 - **Cotton fabric**



- **Non woven fabrics used which are blood repellent results in reduction of bacteria in clothing of operating theatre staff.**

(NJ MITCHELL, DS EVANS, British Medical Journal
1978, 1, 696-698)

* FACEMASK



- * Loose fitting , disposable ,stop droplets from being spread by person wearing it.
- * Pore size is 16-51um while size of virus is 20nm
- * Not use to protect against breathing small particles

* RESPIRATORS

- * Fit tightly to face
- * Protect from breathing very small particles capable of causing airborne infection.
- * N95 , N99 are used .They are 95-99% efficient in filtering 0.3u size particles.



*SURGICAL GLOVES



* SIR WILLIAM HALSTED First used gloves

* Protect operator from infection by bacteria & viruses from patient's blood & patient by surgeons skin flora.
Pore size is 0.1 - 0.2u

* *TYPES:*

- * 1]Latex- Most common ,superior tactile sensitivity
- * 2]Polyisoprene- without risk of rubber latex sensitivity
- * 3]Neoprene- Cost effective, safe for latex sensitive individuals



* GUIDELINES IN THEATRE

- * 1] avoid injury to patient and staff
- * 2] sharps should be kept in receivers and disposed of safely
- * 3] instrument should not be left on drapes
- * 4] disposable instrument should be discarded in labelled container
- * 5] no body fluids remain in instrument after washing
- * 6] swabs should be counted & stored in special plastic racks

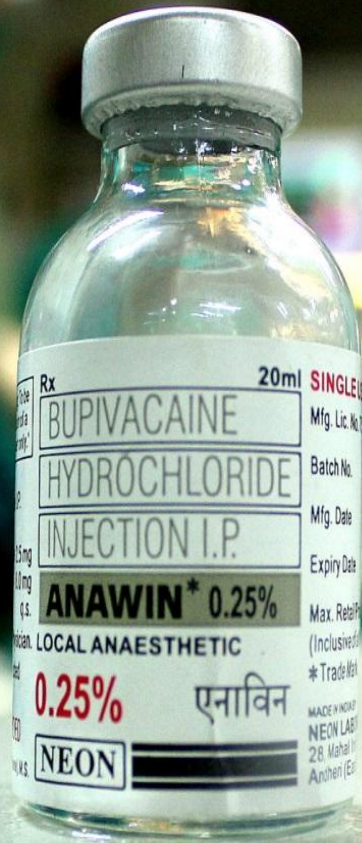


*CONCLUSION

*STRICTLY FOLLOWING THE PROTOCOLS OF STERILISATION & DISINFECTION WILL RESULTS IN DECREASE IN SURGICAL INFECTIONS & POSTOPERATIVE DISCOMFORT.

REFERENCES

- * **Anantnarayan-Textbook of Microbiology**
- * **LJ Peterson-Cotemporary Oral & Maxillofacial Surgery**
- * **Laskin-Textbook of Oral & Maxillofacial Surgery**
- * **NA Malik-Textbook of Oral & Maxillofacial Surgery**
- * **Satoskar- Pharmacology & pharmacotherapeutics**



THANK YOU