

UNIT 5

INFECTION CONTROL, STERILIZATION AND CARE OF SURGICAL INSTRUMENTS

A. INFECTION CONTROL

- Infection control is the discipline concerned with **preventing** healthcare-associated **infection**.
- Infection control addresses factors related to the spread of infections within the health-care setting (whether patient-to-patient, from patients to staff and from staff to patients, or among-staff)

Ventilation of operation theatre



Technique of infection control

Ventilation of operation theatre

- The ventilating system has a very large part to play in limiting infection. The temperature at **68 -70 °F** with a humidity of **30-60 %**. This reduces bacterial growth.
- Air flow should be filtered through **HEPA** system.



Aseptic technique

- Entering the theater with:
 - **Gowning**
 - **Gloving**
 - Wear Eye or face **shields** should be worn during procedures that are likely to generate blood droplets or other body fluids to prevent exposure of mucous membranes of the mouth, nose and eyes.
 - **Cleaning** the theater
 - **Decontamination** of furniture and fixed equipment

B.STERILIZATION AND CARE OF SURGICAL INSTRUMENTS

- Surgical instruments may be damaged if used for unintended purpose.
- Proper **handling**, **cleaning**, and **sterilization** will ensure surgical instrument perform as intended and extend their useful life.

CARE and HANDLING

❑ RINSING

- Immediately after surgery, rinse instruments under **warm** running water. Rinse should **remove** all blood, body fluids and tissue.

❑ CLEANING

- If not done immediately after rinsing, instruments should be submerged in a solution of **water** and neutral P^H **detergent**.

Sterilization and disinfection

- **Sterilization** is a process where by all microorganisms, including heat resistant bacteria are **removed or destroyed**.
- **Disinfection** is the process of removing or destroying microorganisms to a level which is safe for some purpose but not for all. With this method heat resistant **spores** will **not** be destroyed.

Sterilization...

- Sterilization is an essential stage in the processing of any product destined for parenteral administration, or for contact with broken skin, mucosal surfaces, or internal organs, where the treat of infection exists.
- In addition, the sterilization of microbiological materials, soiled dressings and other contaminated items is necessary to minimize the health hazard associated with these articles.

Sterilization...

- The processes used to control microorganisms are either physical or chemical methods.
- The method chosen depends on the circumstances and resulting degree of control required.

1. Physical methods:-include heat treatment, irradiation and Filtration

2. Chemical methods:-use any one of a variety of antimicrobial Chemicals

N.B. The success of the process depends upon a suitable choice of *treatment conditions*, e.g. T° and duration of exposure

Sterilization...

- ❖ It is good to have knowledge of:
 - ✓ the properties of the sterilizing agent,
 - ✓ the properties of the product to be sterilized and
 - ✓ the nature of the likely contaminants.

- ❖ A suitable sterilization process may then be selected to ensure maximum microbial kill/removal with minimum product deterioration.

I. Heat sterilization

- ❖ Heat is the most reliable and widely used means of sterilization
- ❖ This method of sterilization is limited to thermostable products
- ❖ Where thermal degradation of a product might possibly occur, it can usually be minimized by selecting the higher temperature range, as the shorter exposure times employed generally result in a lower fractional degradation.

Heat sterilization...

- The lethal effectiveness of heat on microorganisms depends on:
 - The degree of heat
 - The exposure period
 - The moisture present
- The time requires to produce a lethal effect is inversely proportional to the temperature employed.
- And the temperature required to sterilize a product is inversely related to the moisture present.

Heat sterilization...

Sterilization process

- Heat sterilization process involves three stages:-
 - Heating stage
 - Holding stage
 - Cooling stage

Heat sterilization...

a) Steam sterilization(autoclave)

- It requires temperature above that of boiling water. Such conditions are attained under controlled conditions by raising the pressure of steam in a pressure vessel.
- Widely used method for heat sterilization is the **autoclave**.

Heat sterilization...

- To achieve sterility, a holding time of at least **15 minutes at 121 °C** or **3 minutes at 134 °C** is required.
- It is suitable for sterilizing metal instruments and appliances, various kinds of heat resistant glass items, syringes, dressings, surgical and diagnostic equipment,
- Saturated steam is more sufficient than dry heat

Heat sterilization...

- Steam sterilization requires four conditions in order to be efficient:
 - ✓ **adequate contact,**
 - ✓ **sufficiently high temp.**
 - ✓ **correct time and**
 - ✓ **sufficient moisture.**



Heat sterilization...

b) dry heat (in an oven).

- Dry heat sterilization usually employs higher T^0 in the range 160-180°C and requires exposure times of up to 2 hours depending upon the T^0 employed.
- Dry heat application is generally restricted to glass ware and metal surgical instruments,
- Dry heat sterilization is performed at **170 C** for **1hr** or **2 hrs** at a temperature of **160 C**.
- Dry heat sterilization can also be performed at **121 C**, for at least **16 hours**.

II. Chemical sterilization

- Also referred to as **cold sterilization**, can be **used to** sterilize instruments that **cannot normally be disinfected** through the other two processes described above.

A) Ethylene oxide

- Ethylene oxide gas is commonly used to sterilize objects **sensitive** to temperatures greater than **60 °C** and / or radiation such as plastics, optics and electrics.

Chemical sterilization...

- Ethylene oxide treatment is generally carried out between **30 °C** and **60 °C** with relative humidity above 30% and a gas concentration between 200 and 800 mg/l, and typically lasts for at least 3 hrs.
- It can kill all known viruses, bacteria and fungi, and is **compatible** with most materials (e.g. of medical devices).

Precaution: it is highly flammable, toxic and carcinogenic.

Chemical sterilization...

B) Glutaraldehyde and formaldehyde

- Glutaraldehyde and formaldehyde solutions are accepted liquid sterilizing agents, provided that the **immersion time** is sufficiently **long**.

c) Hydrogen peroxide

- H_2O_2 is another chemical sterilizing agent. It is relatively **non-toxic** when diluted to low concentrations, such as the familiar 3% retail solutions although hydrogen peroxide is a **dangerous oxidizer** at high concentrations (> 10% w/w).

Disinfection

- ❑ It is the process of removing microorganisms, including potentially pathogenic ones, from the surfaces of inanimate objects.
- ❑ The term high level disinfection indicates destruction of all microorganisms but *not necessarily bacterial spores*.
- ❑ Antisepsis is defined as destruction or inhibition of microorganisms on living tissues having the effect of limiting or preventing the harmful results of infection.
- ❑ They are mostly used to reduce the microbial population on the skin before surgery or on the hands to prevent spread of infection by this route.

Other methods

- Other heat methods include
 - flaming
 - incineration
 - Boiling in water

After cleaning and sterilization

- Any instruments are to be stored, let them air dry and store them in a clean and dry environment.

Medical Laboratory equipments

Laboratory instruments can be categorized as

♠ **Hematology instruments** , eg. Hematology analyser, hemoglobin meter

♠ **Immunological instruments**

♠ Centrifuges,

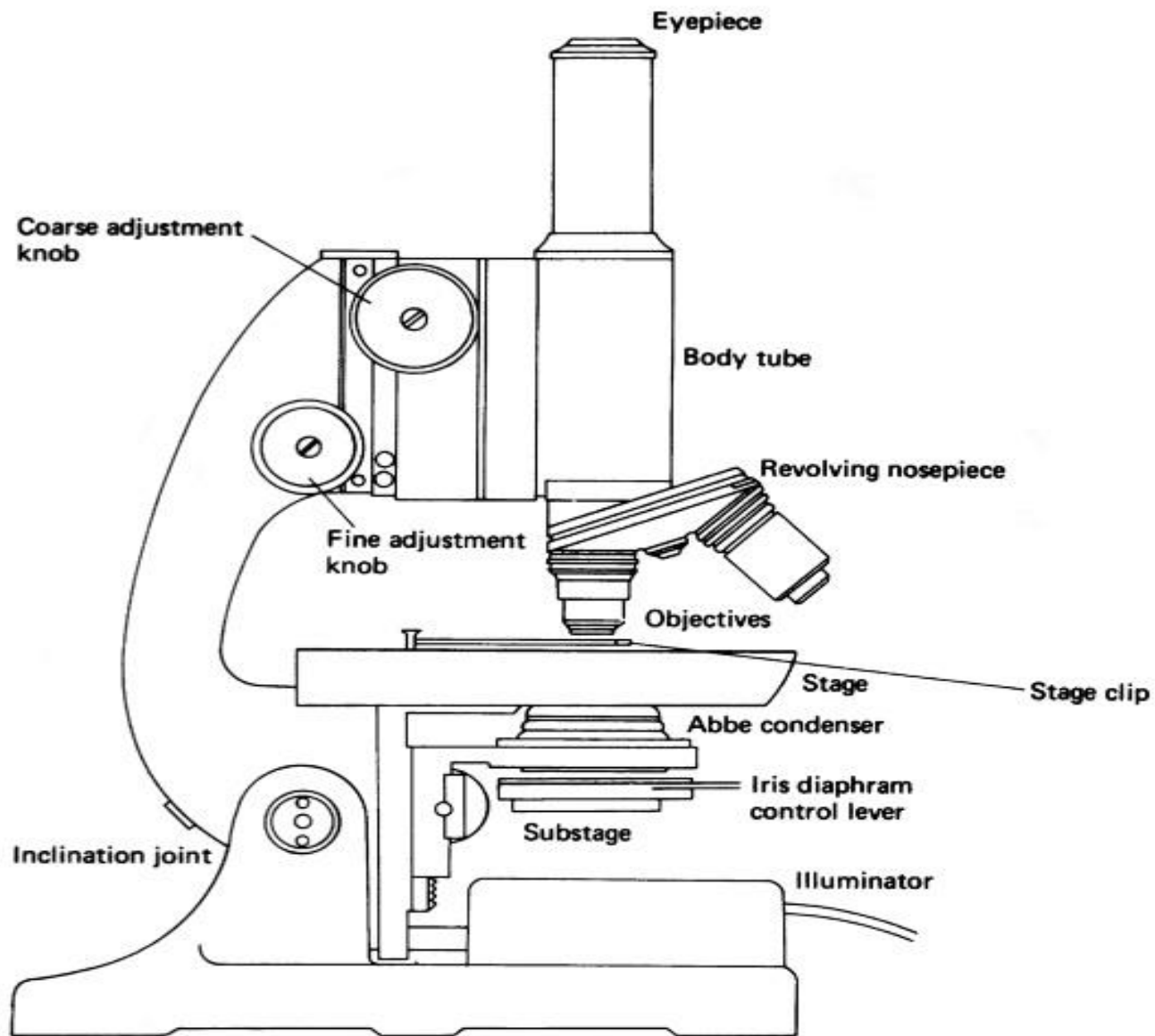
♠ **ELISA** reader (also known as an **enzyme immunoassay (EIA)**, is a biochemical technique used mainly in **immunology** to detect the presence of an **antibody** or an **antigen** in a sample), incubators

Medical Laboratory...

- ♠ **Hormone Analysis** instruments- eg. ELISA washer, centrifuge,
- ♠ **Urinalysis instruments-** Microscope, centrifuges
- ♠ **Clinical Chemistry-** eg. Chemistry analyser, centrifuges, electrolyte analyser
- ♠ **Histological instrument-**eg. Tissue processors(for fixing, dehydrating, clearing and paraffin impregnating), water bath, Microtome
- ♠ **Medical Research/referral laboratory instruments** e.g Biological safety cabinet in TB lab

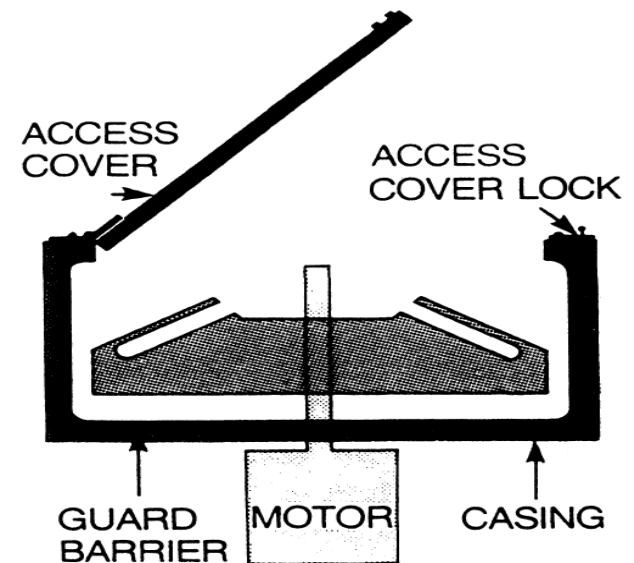
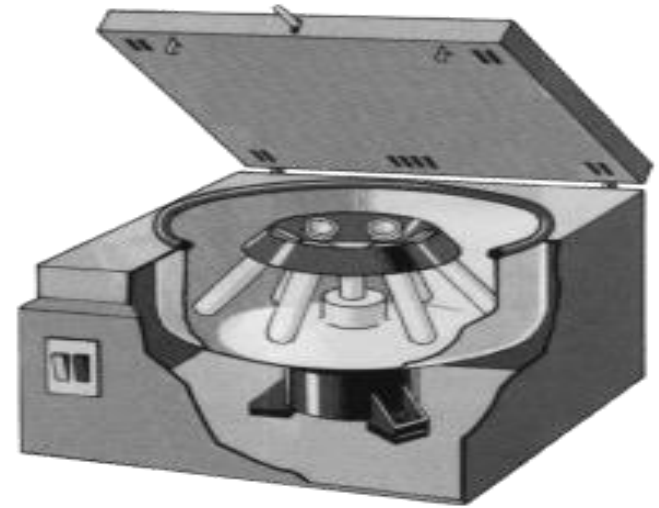
The Microscope

- A microscope is an instrument that uses a lens or a combination of lenses **to magnify** and **resolve the fine details of an object**.
- Have **Optical System** (objective lens, eye piece) and **Mechanical System**(base, arm, Stage, body tube, coarse adjustment, fine adjustment)



Centrifuge

- Centrifuge: a motor-driven machine used in laboratories to **separate components**, or to **alter the local distribution of components of a system** by means of centrifugal acceleration in rapidly rotating vessels/tubes



Incubators

- Most incubators are used to **provide a controlled temperature** (and sometimes a controlled humidity. Usually, this is about body temperature, **37°C**, through a thermostat. This is the **most suitable temperature for most bacteria in culture media**.
- An incubator comprises a transparent chamber and the equipment that regulates its temperature, humidity, and ventilation.



Spectrophotometer

- An instrument which can **measure the absorbance of a sample at any wavelength.**
- Uses Beer – Lambert Law (law that relates *absorbance*, *concentration* and *transmittance*)



Biological Safety cabinet

- A biological safety cabinet is a ventilated cabinet which uses a variety of combinations of **HEPA**(High Efficiency Particulate Air) filtration, laminar air flow and containment to **provide either personnel, product or environmental protection or protection of all components** against particulates or aerosols from biohazardous agents.

