MEDICAL INSTRUMENTS-II

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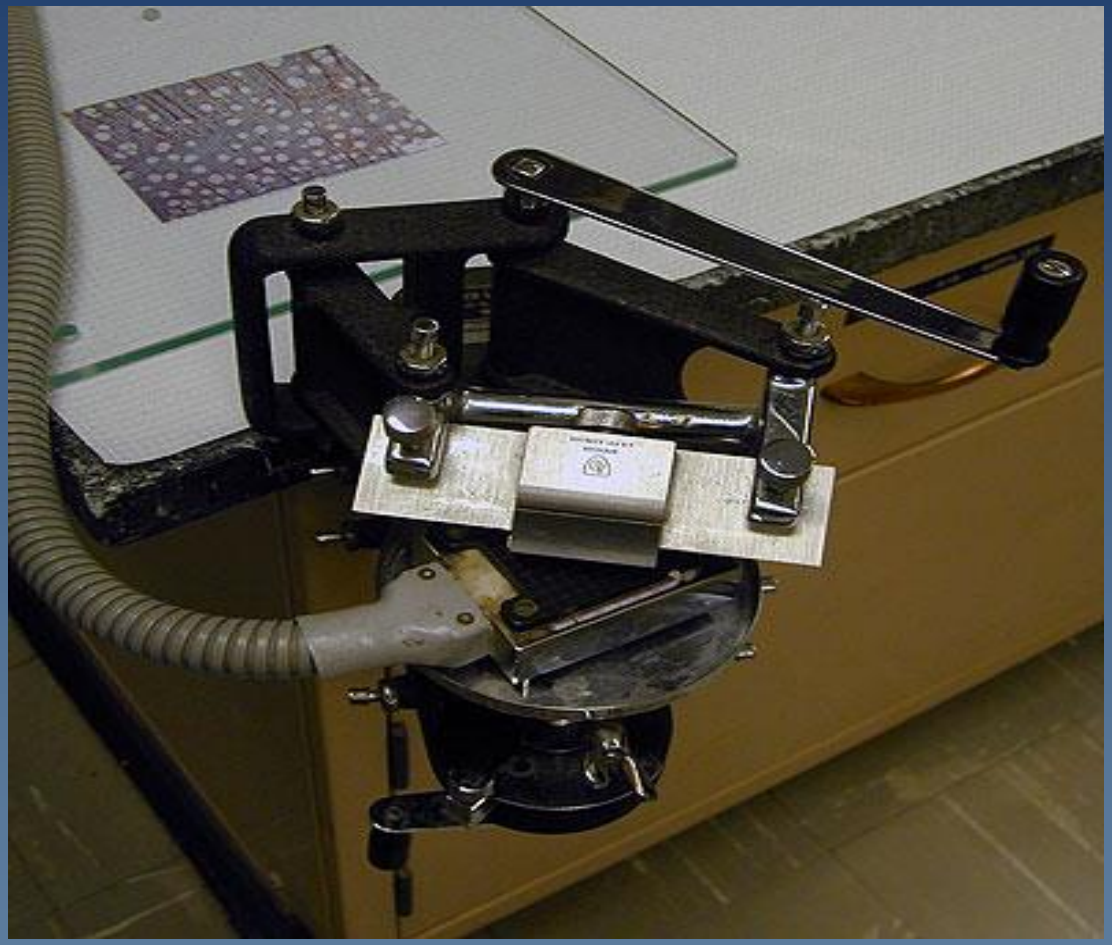
Freezing microtome

- Simple type of freezing microtome is clamped to the edge of a bench and is connected to a cylinder of carbon dioxide by means of a specially strengthened flexible metal tube.
- It consist of a radial arm attached to a central pivot. On this arm, two clamps hold a wedge profile microtome knife mounted with a simple block holder, with a cutting edge inclined in a horizontal plane.

Working principle

- The object is mounted on a block holder (chuck) known as freezing stage, with a centrally advancing screw. The block holder is perforated and attached to a feed pipe carrying carbon dioxide gas, which is sprayed on to the tissue for freezing. The knife moves over the block around a horizontal axis when once the tissue hardens.
- Thermoelectric cooling device units may be used in place of carbon dioxide gas to freeze the tissue and cool the knife. The cooling produced by thermoelectric units depends upon the flow of direct current, which may be regulated by means of power packs. In this stage, temperature can be reduced from ambient to -36C in 60 seconds, but the optimum cutting temperature for the tissue is usually about -20C.

Freezing microtome



Advantages:

- Freezing microtome is used in the demonstration of fat
- Ideal for brain sectioning.
- Simple design with no complex moving parts.
- Can be of diagnostic use when affordability of cryostat is not possible.
- Better demonstration of soluble and diffusible substances.
- Easy to operate and maintain.

Disadvantages:

- The sliding knife tends to jump on striking hard tissue.
- Difficult to sharpen the long knife.
- No serial sectioning possible.
- Sections less than 8 u cannot be cut under the best of conditions.

CRYOSTAT

- The first cryostat was introduced in 1959.
- (‘cryo’ meaning cold and ‘state’ meaning stationary)
- Cryostat is a refrigerated cabinet in which a microtome is housed. The microtome used is usually a rotary type, but may of sliding type or even rocking type and is rust proof. The microtome is mounted in a stainless steel cabinet at an angle of 45 degree. It has an antifogging air circulating system, a drain for defrosting and a shelf for four to six metal block holders. Cabinet temperature is -5 to -30 ^C. All microtome control operation are outside the cabinet.

  Harris International Microtome is most commonly used.

  This unit operates on the ‘open top-cold box’ principle.

Working principle

- To create a cold atmosphere around tissue block holder and microtome by means of a special refrigerator type compressor capable of taking temperature below -30 to -50 C. The reason for freezing the tissue is to provide a hardened matrix for sectioning the tissue and at the same time, preserving biochemical or immunological properties of a cell or tissue. The coolant used is usually Freon 22.

- **Advantages**
- Used extensively for rapid diagnosis, fat stains and enzyme histo-chemistry in neurological applications as well as in fluorescence microscopy.
- Both the knife and tissue are maintained at same low temperature.
- Capable of slicing sections as thin as 1 um
- Serial sectioning is possible.
- Automatic defrosting and sterilization
- Antifogging air circulatory system.

- **Disadvantages**
- Constant supervision and maintenance of temperature is required.
- The whole instrument should be kept in an air-conditioned room to prevent excessive cryostat compressor functioning.
- Lubricants of special type with a low congealing point have to be used. This prevents the lubricants solidifying at a cooler temperature within the chamber.
- Freeze artifacts seen as holes in the tissues.
- If the temperature is too low, the tissue become hard and crumbles, and becomes difficult to cut.
- Difficulty in sectioning fixed tissue.
- High cost of the instrument.

Difference between a Microtome and a Cryostat

- A Microtome is used to cut very thin sections at room temperature, on the other hand a Cryostat is used to cut frozen sections at sub zero temperatures (generally -30 deg C).

- A cryostat is used in situations where rapid analysis of tissues is required. The water rich tissue is frozen on a quick freezing shelf inside the cryostat, this makes it very hard and it is then ready to be cut into thin sections in a microtome, also placed inside the cryostat chamber.

- On the other hand to be cut in a simple microtome, the tissue needs to be first dehydrated and fixed in paraffin before it can be sectioned. It is a long procedure compared to quick sectioning in a cryostat.

- The quality of sections cut in a cryostat is inferior compared to those cut in a microtome because dehydrated and paraffin embedded tissues give better sections but when it comes to quick sectioning, Cryostat is the choice.

FIOW CHART


Tissue
Tissue Processing
Tissue embedded
Slice cut
Slice cut
Tissue
fiotation and dry
Cryostat section
HE Staining
Microscope
analyze