

ROUTES OF DRUG ADMINISTRATION



Choice of route depends on

- Characteristic of the drug
- Emergency/routine use
- Age
- Patient's and doctor's choice
- Associated disease
- Condition of the patient

Route of drug administration

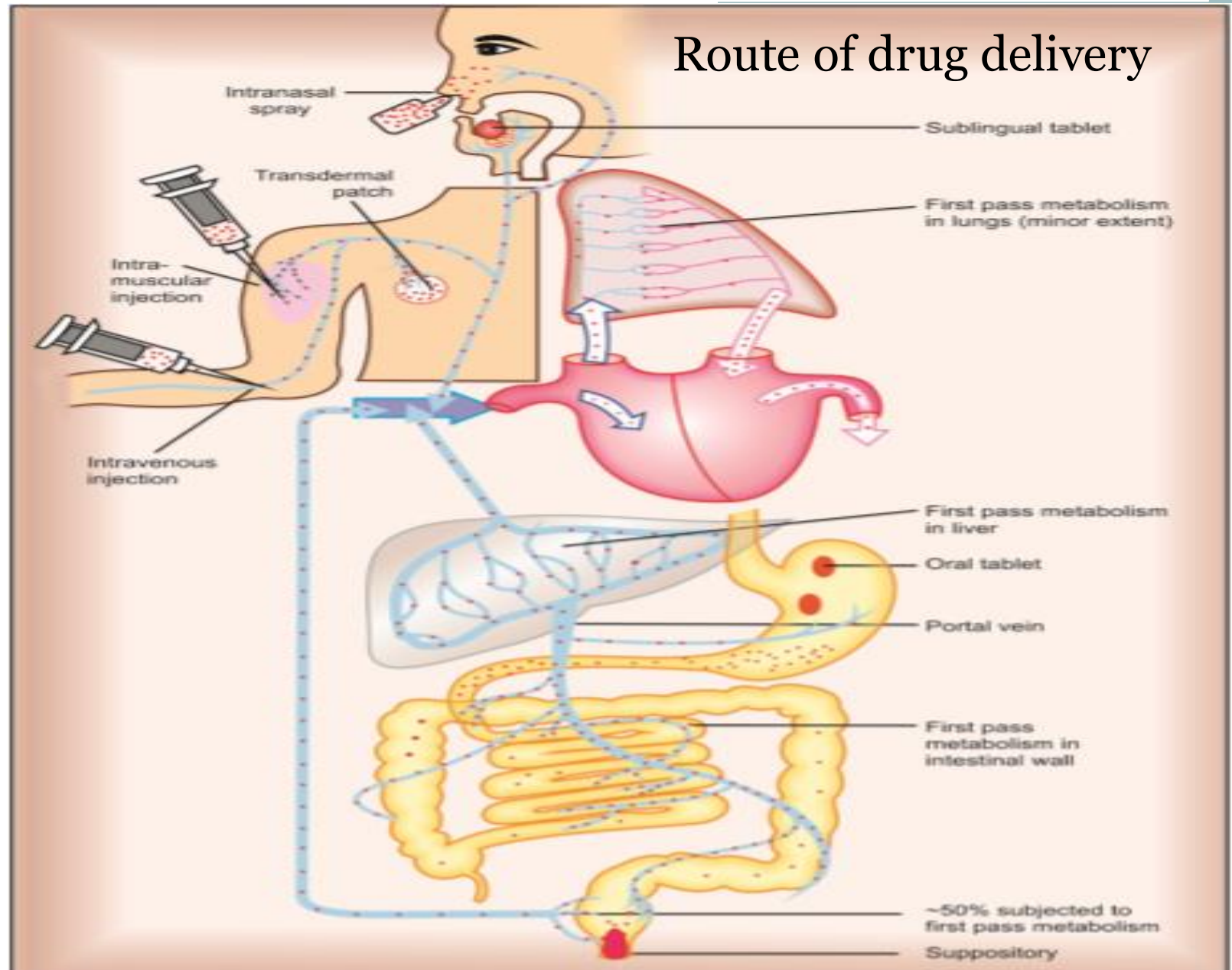
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graph TD; A[Route of drug administration] --> B[Enteral(oral)]; A --> C[Parentral]; A --> D[Topical/Local];
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Enteral(oral)

Parentral

Topical/
Local

Route of drug delivery



Enteral route

Oral - Advantages

- Safest
- Convenient
- Economical
- Self medication
- Non invasive



Disadvantages

- Slower onset
- Irritant and unpalatable drugs cannot be given
- Some drugs may not be absorbed
- Irregular absorption
- Irritation to GIT may lead to vomiting
- Destroyed by gastric juices - **Insulin**
- Cannot be given to unconscious and uncooperative patients
- Extensive first pass metabolism in liver

Enteric coated tablets



Coated with cellulose acetate, gluten

- Prevent gastric irritation
- Avoid destruction of drug in stomach
- Provide higher concentration in small intestine
- Retard the absorption there by prolong the duration

- **Sustained release**

Advantages

- Frequency of administration reduced
- Therapeutic concentration may be maintained

Disadvantages

- Failure of preparation
- More expensive



Parenteral Route

Advantages

- Action rapid and predictable – useful in emergency
- Employed in unconscious and uncooperative patients
- Irritation to GIT can be avoided
- Can be used in patients with vomiting and those unable to swallow
- Digestion by gastric and intestinal juices and first pass metabolism is avoided.

Disadvantages

- Asepsis must be maintained
- Injections may be painful
- More expensive, less safe and convenient
- Injury to nerve and other tissues may occur
- Self medication difficult

Parenteral

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graph TD; Parenteral --> Injection; Parenteral --> Inhalation; Parenteral --> Transdermal; Parenteral --> Transmucosal; Injection --> Intradermal; Injection --> Subcutaneous; Injection --> Intramuscular; Injection --> Intravenous; Injection --> Intraperitoneal; Injection --> Intrathecal; Injection --> Intra-articular; Injection --> Intra-arterial; Injection --> Intramedullary; Transdermal --> Adhesive unit; Transdermal --> Ionophoresis; Transdermal --> Jet injection; Transmucosal --> Sublingual; Transmucosal --> Nasal; Transmucosal --> Rectal
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Injection

Intradermal
Subcutaneous
Intramuscular
Intravenous
Intraperitoneal
Intrathecal
Intra-articular
Intra-arterial
Intramedullary

Inhalation

Transdermal

Adhesive unit
Ionophoresis
Jet injection

Transmucosal

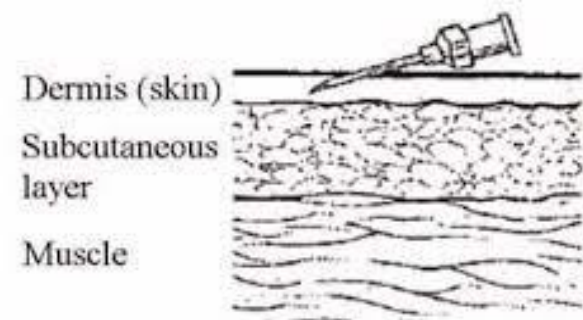
Sublingual
Nasal
Rectal

Intradermal

The drug is injected :



- Into layers of the skin raising Bleb e.g. **BCG vaccine, test for allergy**
- By multiple punctures of the epidermis through a drop of drug eg. **Small pox vaccine**



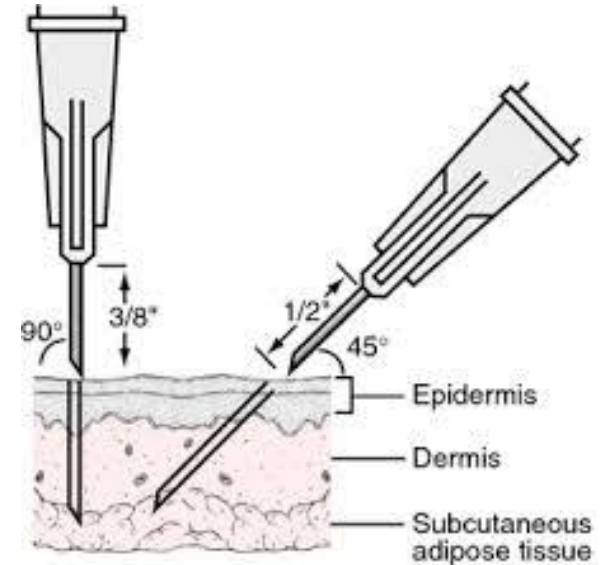
Subcutaneous

Advantages

- Drug is deposited in subcutaneous tissue eg **insulin, heparin**
- Smooth absorption but slower
- Reliable and patient can be trained for self medication

Disadvantages

- Irritant drugs can cause sever pain
- In shock absorption is not dependable because of vasoconstriction
- Repeated injections at the same site can cause lipoatrophy

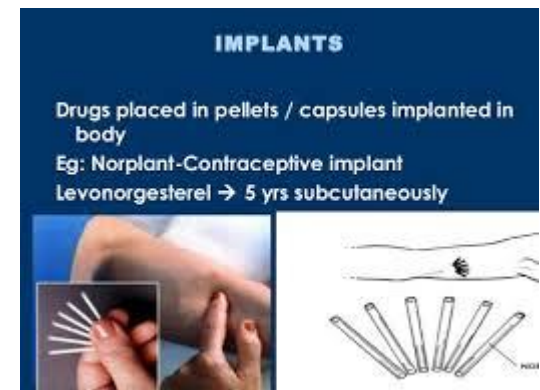


Drugs can also administered SC as

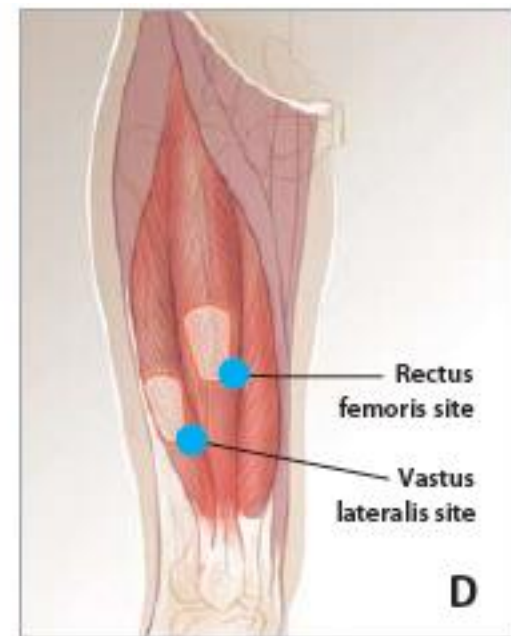
- Hypodermoclysis
- Dermojet
- Pellet implantation
- Sialistic implantation



estosterone Treatment with Subcutaneous Pellet Implants



Intramuscular



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FIGURE 1B, C, D. Potential sites for intramuscular injection: Deltoid, ventrogluteal, rectus femoris, and vastus lateralis sites

Intramuscular

Advantages

- Reliable
- Absorption is rapid
- Soluble substance, mild irritants, depot preparations, suspensions and colloids can be injected



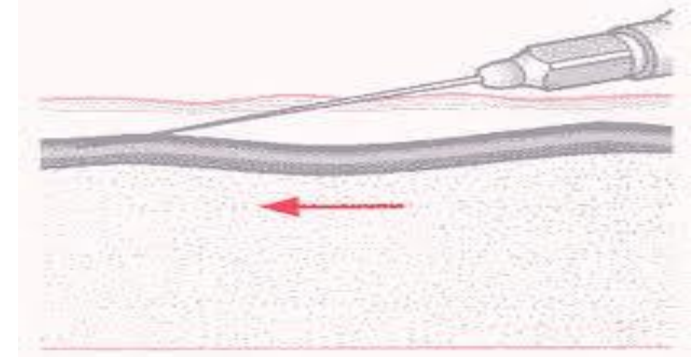
Disadvantages

- May be painful
- Irritant drug can damage nerve
- Local infection and tissue necrosis
- For some drugs absorption may be slower than oral
- For some drug IM avoided-heparin, diazepam, calcium, tetracycline, gluconate

Intravenous

Drugs can be given IV as

- A Bolus - Heparin
- Slow injection - Aminophylline
- Slow infusion – Dextrose ,Saline



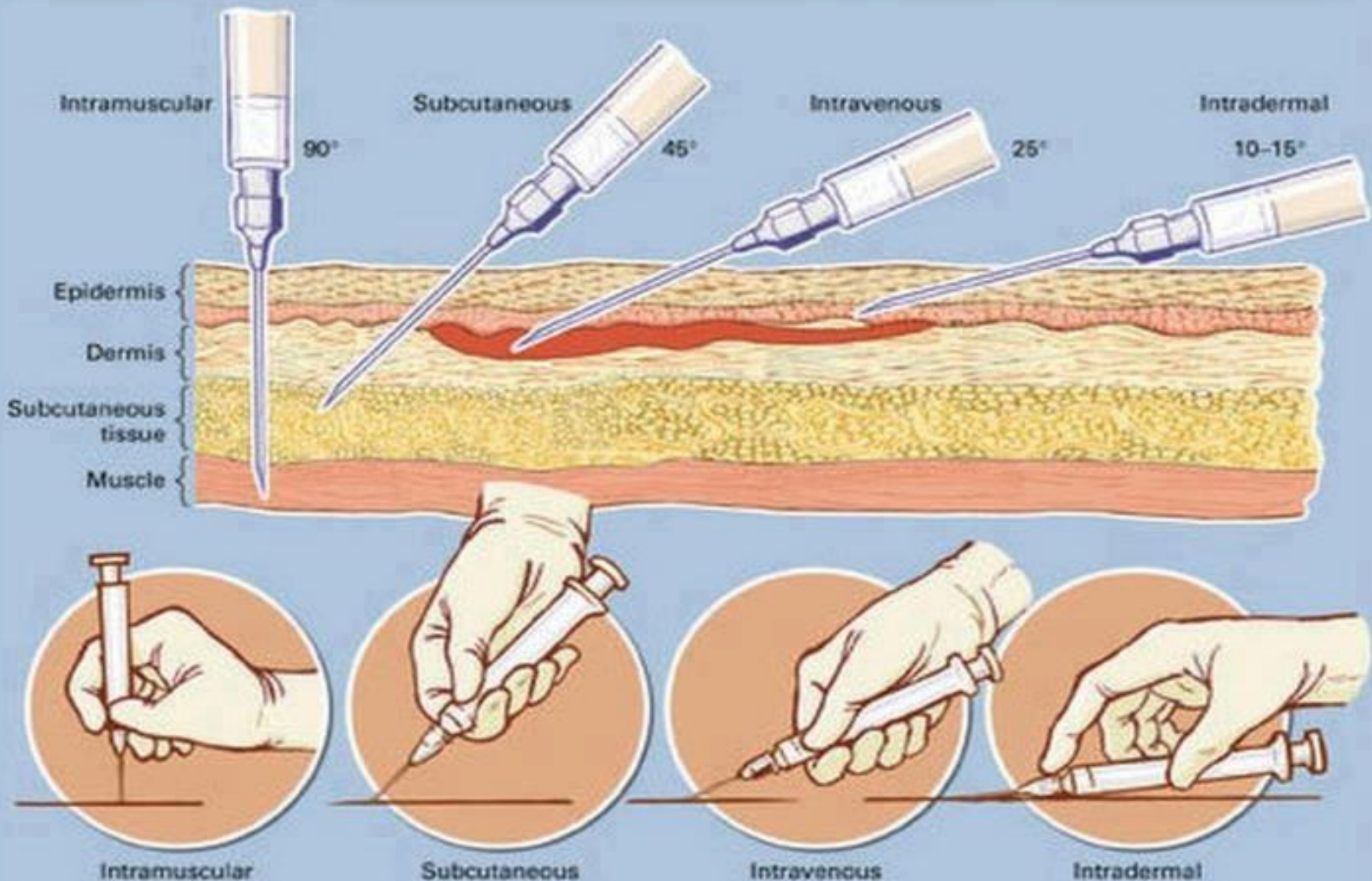


Slow injection



Slow infusion

Angles for inserting injections



Intravenous

Advantages

- Most useful route in emergency
- 100% bioavailability
- Large volumes of solution can be given
- Irritants can be given
- Rapid dose adjustment are possible

Disadvantages

- Once injected drug cannot be withdrawn
- May cause thrombophlebitis
- Extravasation of some drugs may cause severe irritation and sloughing
- Only aqueous solution can be given
- Self medication is difficult

Intraperitoneal



Intrathecal

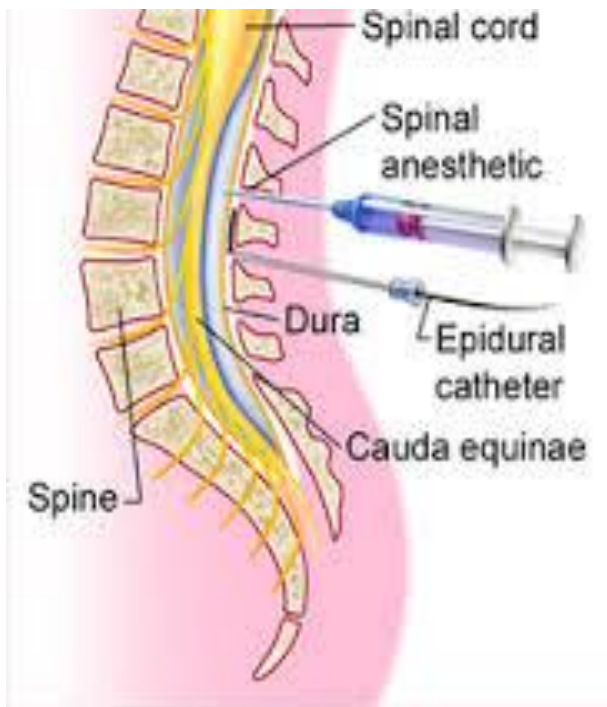
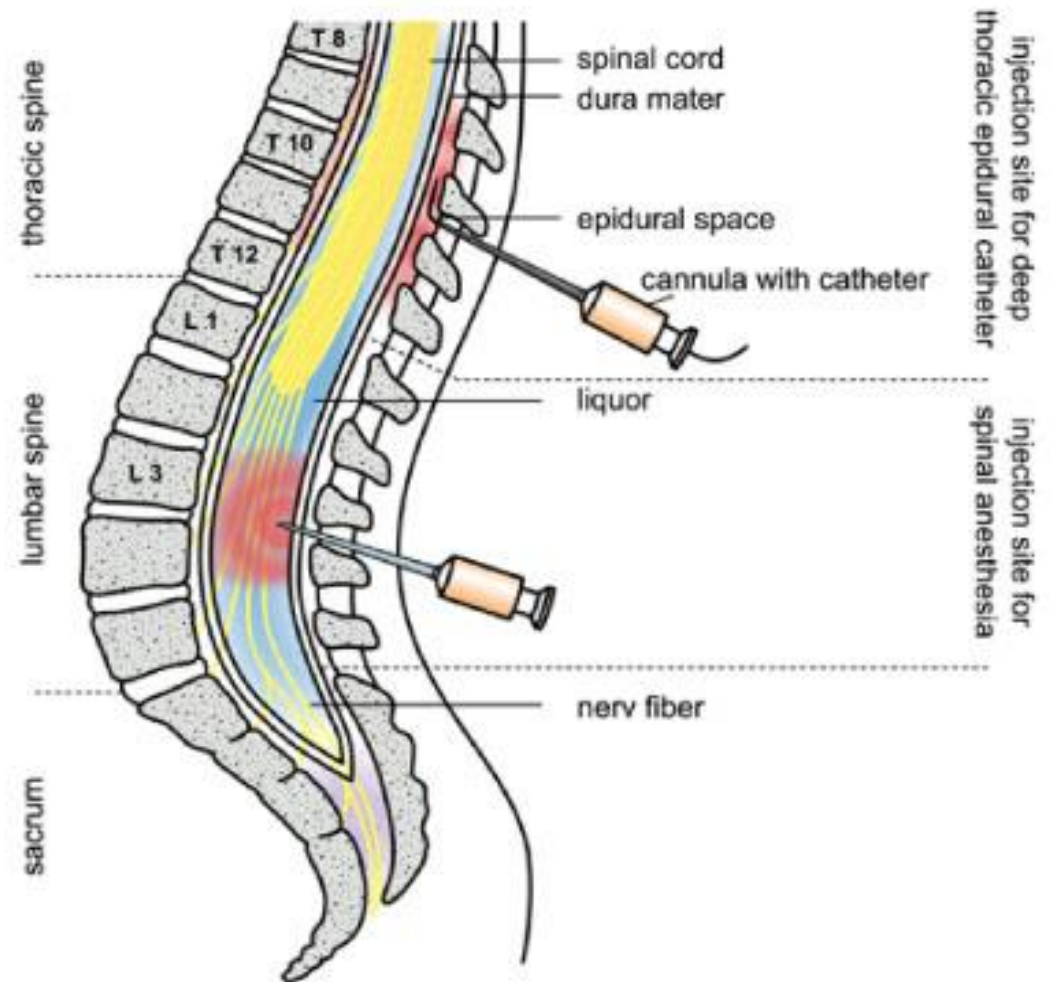
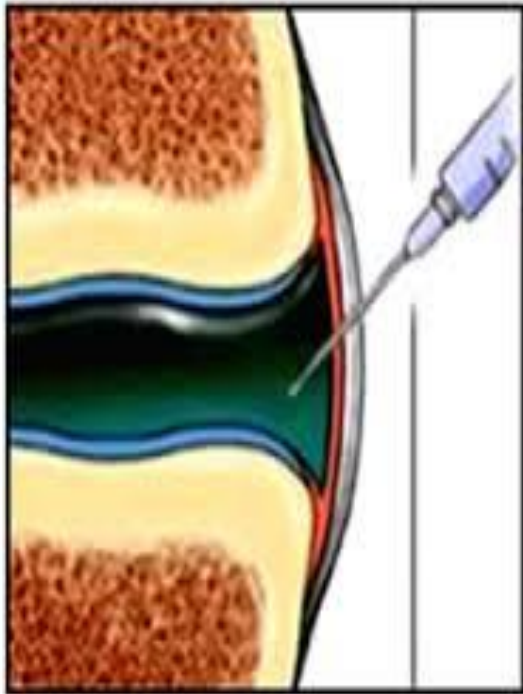


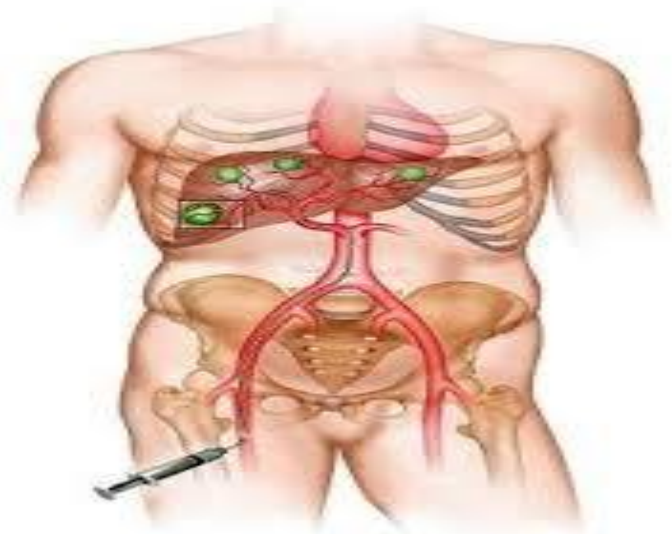
Figure 1 - Method of CSTEА.



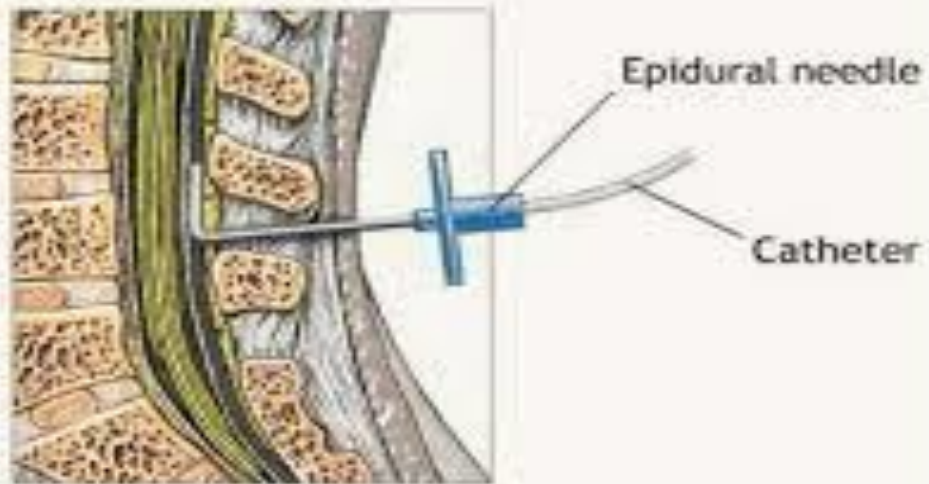
Intra Articular



Intra-arterial



Intramedullary



Inhalational



Metered dose inhalers



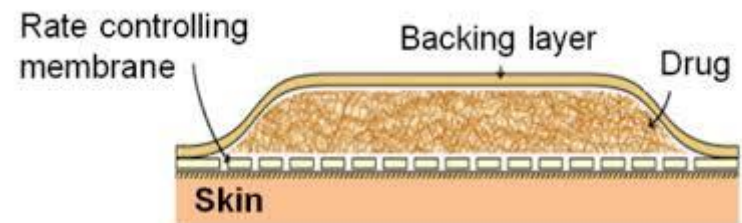
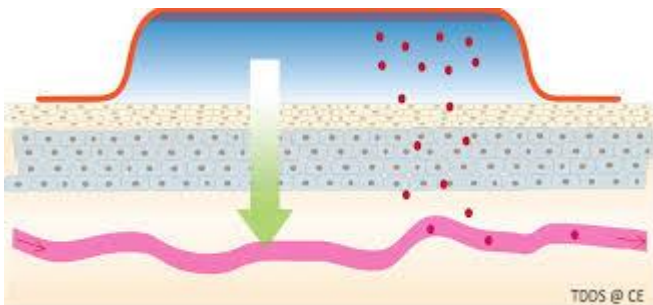
Nebulizer



Dry powder inhaler

Transdermal

- Adhesive unit
- Inunction



Example:

- Hyosin
- Nitroglycerine
- Testosterone
- Estrogen
- Nicotine

Advantages:

Prolonged action

Constant plasma level

Patient compliance

Intophoresis

Eg. Salicylates, fluoride Iontophoresis



IONTOPHORESIS DIAGRAM

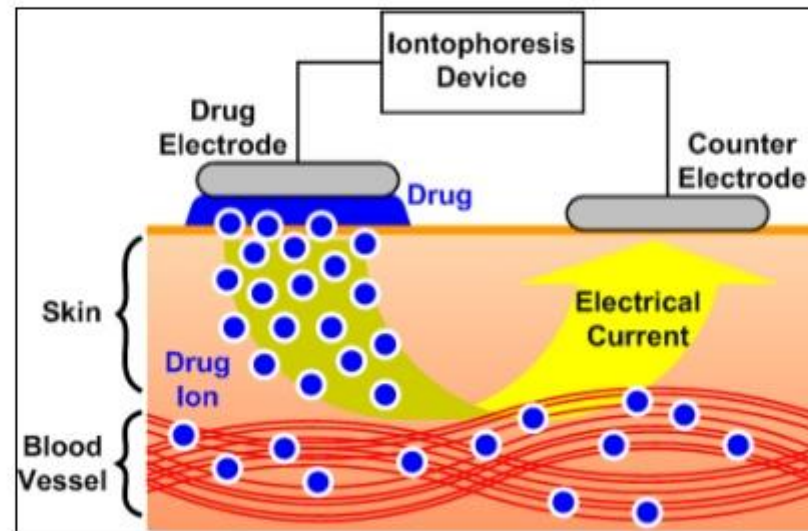
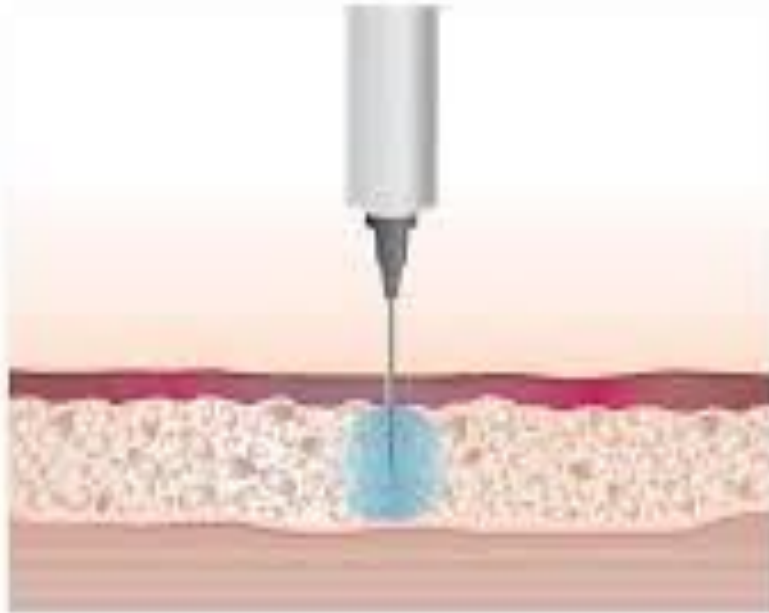
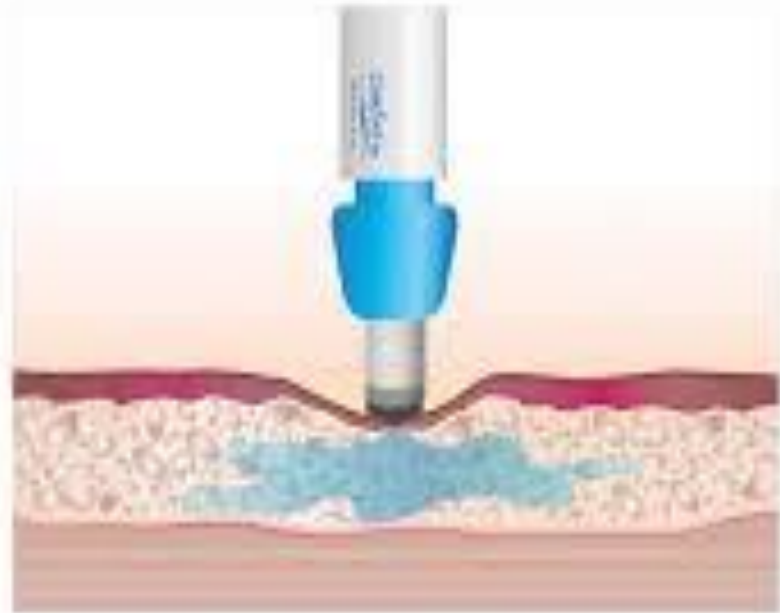


Figure showing transdermal drug delivery by iontophoresis

Jet injection



Needle Injection



Jet Injection

Transmucosal

Sublingual Advantages

- Rapid absorption
- First pass metabolism is avoided
- Avoid unwanted side effect

Disadvantages

- Buccal ulceration
- Lipid insoluble, irritant & unpalatable drug cannot given



Nasal

- **Systemic absorption**

Oxytocin spray

- **Local effect**

Decongestant nasal drops



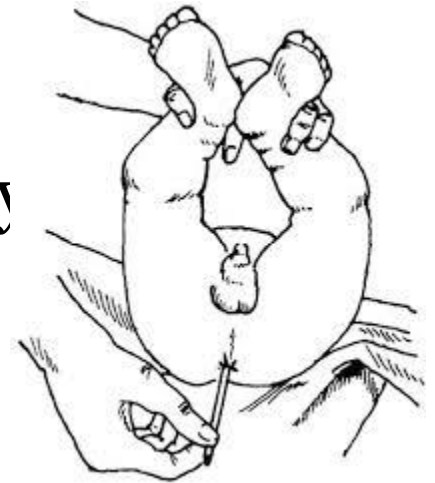
Rectal

Advantages

- Avoid gastric irritation
- Administered by unskilled person
- Useful- elderly ,vomiting, unable to swallow, gastro intestinal surgery unconscious patient

Disadvantages

- Irritation of rectum
- Absorption irregular and unpredictable



Enema

Evacuant

- Empty the bowel
- 600 ml soap water is administered
- Uses- priory to surgeries, obstetric procedures, and radiological examination

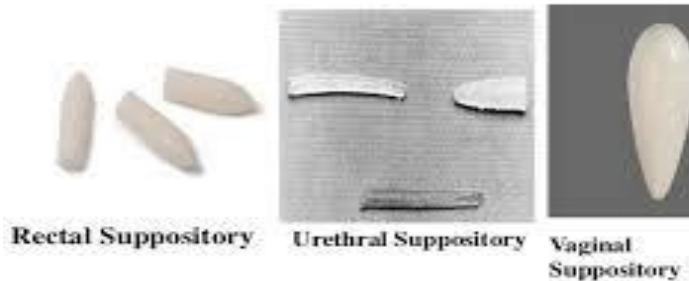
Retention

- Drug is administered with 100 ml of fluid
Eg. Prednisolone edema in ulcerative colitis

Topical

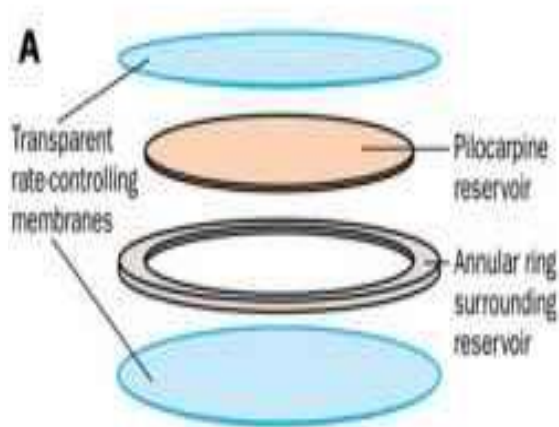
- Skin – ointment gel cream etc.
- Mucous membrane- eye drops
- Suppositories - Rectum
- Bougie – Urethra
- Douche - Vagina

Types of Suppositories (According to Route of administration)



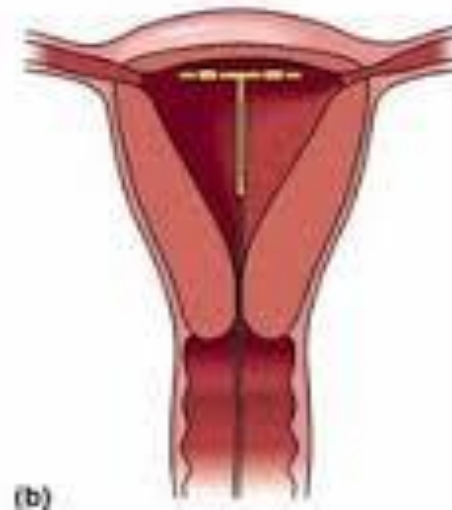
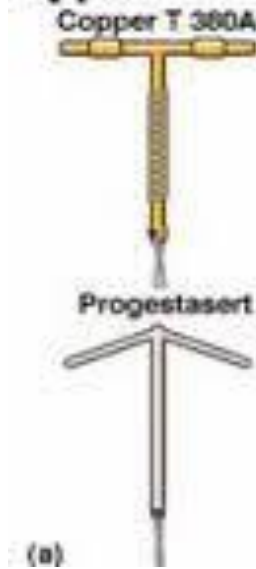
Special drug delivery system

- **Ocusert**



Progestasert

Types of IUDs; An IUD in Position

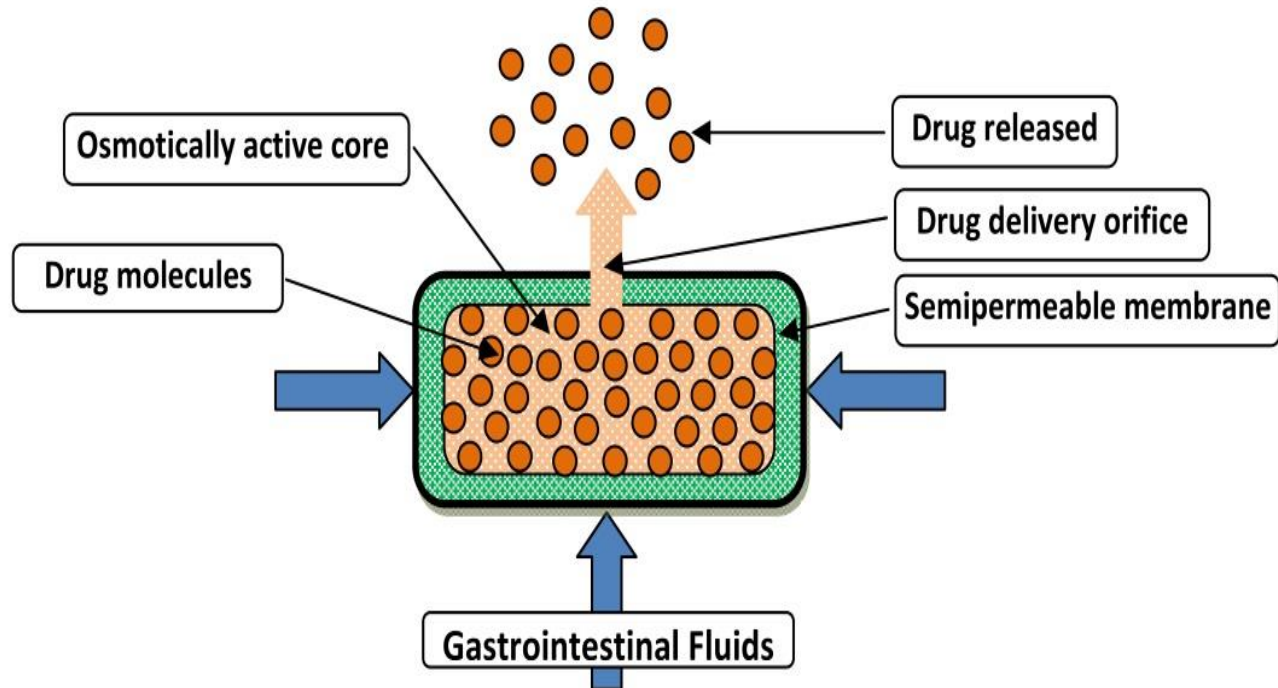


Transdermal drug delivery

Prodrug

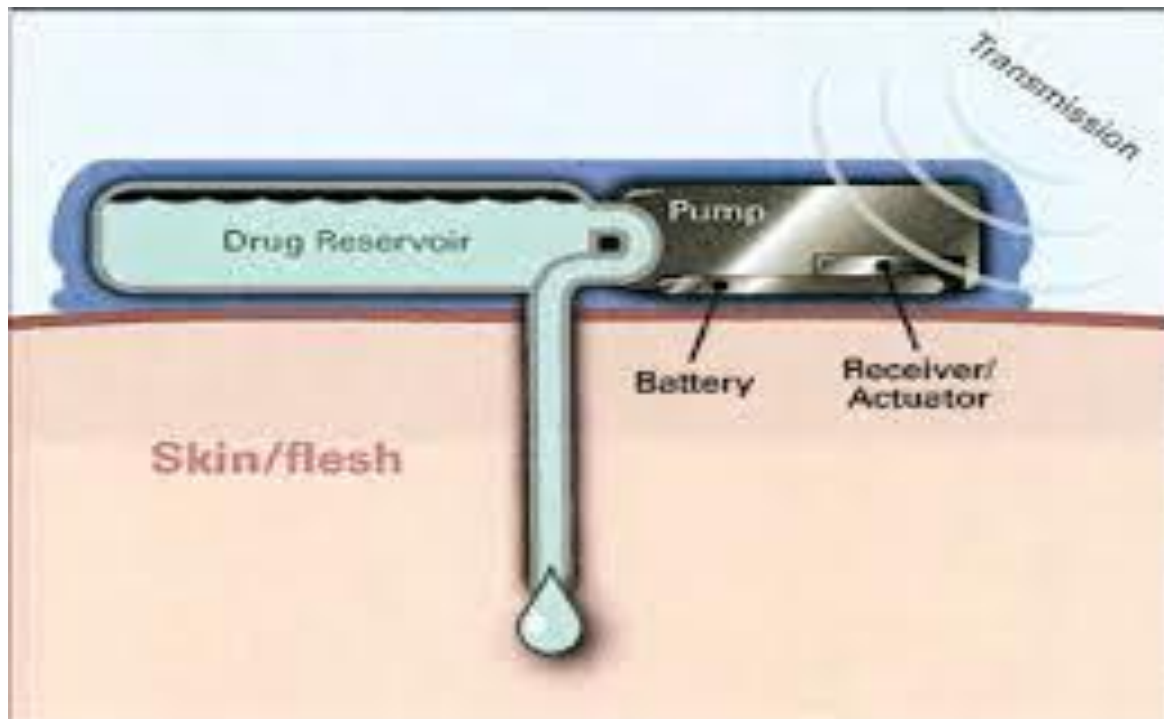
- Enhance availability at the site
- Prolong duration of action
- Improve tolerability
- Drug targeting
- Improve stability

- **Osmotic pump**



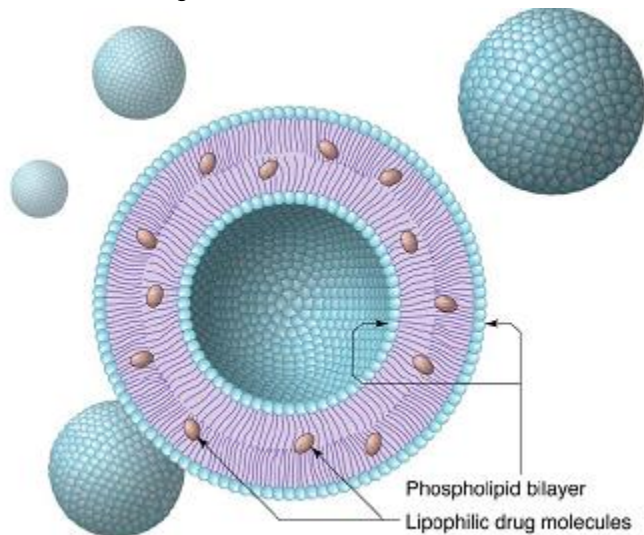
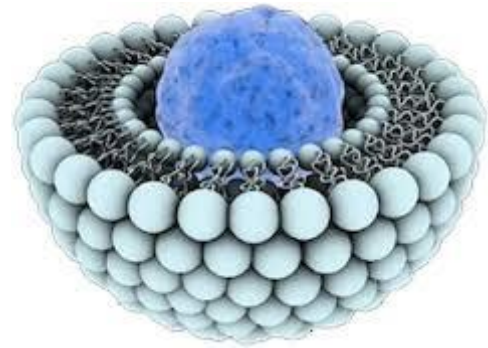
Computerized pump

- Continuously –Insulin
- Intermittently as pulse -GnRh

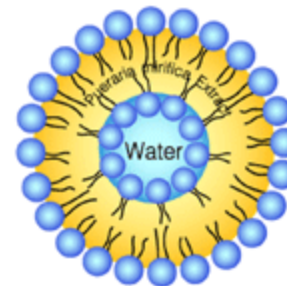


Targeted drug delivery system

- Liposomes
- Monoclonal antibodies
- Nanoparticles
- Polymer based drug delivery system



Liposomes



Nanoparticle

