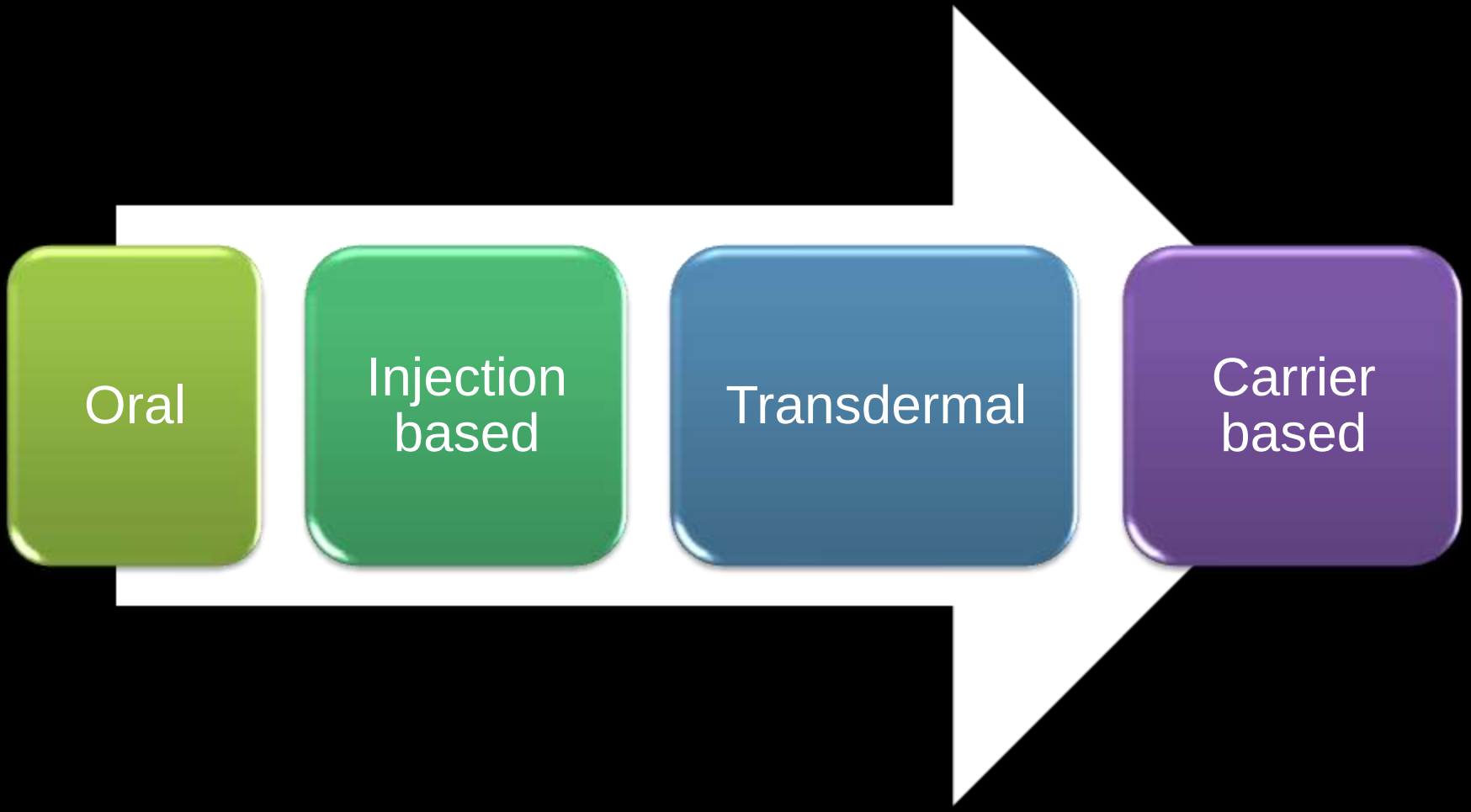
Novel Drug delivery systems

Need for new drug delivery systems

Properties of responsive drug delivery device

- Controlled release profiles, especially for sensitive drugs
- Long-lived, Biocompatible and inexpensive
- Safe from accidental release, easy to fabricate and sterilize and allow high drug loading
- Inert, mechanically strong, easy to implant and remove (patient compliance)
- Continuous monitoring, telemetric data transfer and allow physician intervention if needed

Various types of Drug delivery



Oral Drug delivery systems

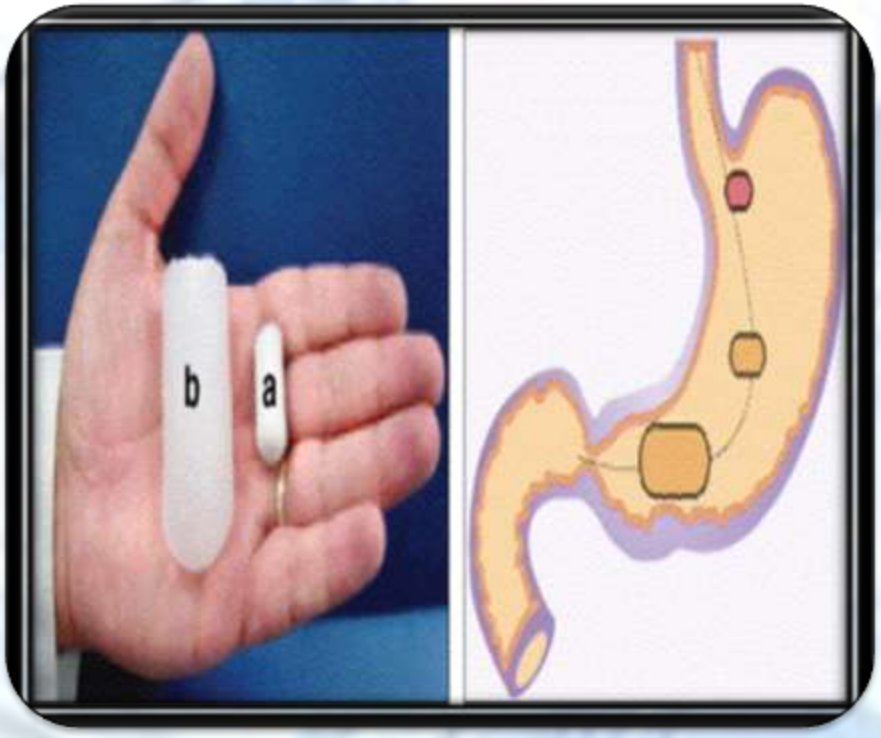
Formulations range from simple tablets to newer modified control release tablets

Involve use of various polymers and hydrogel based formulations

Thin film drug delivery

Oral drug strips to administer drugs via absorption buccally/sublingually

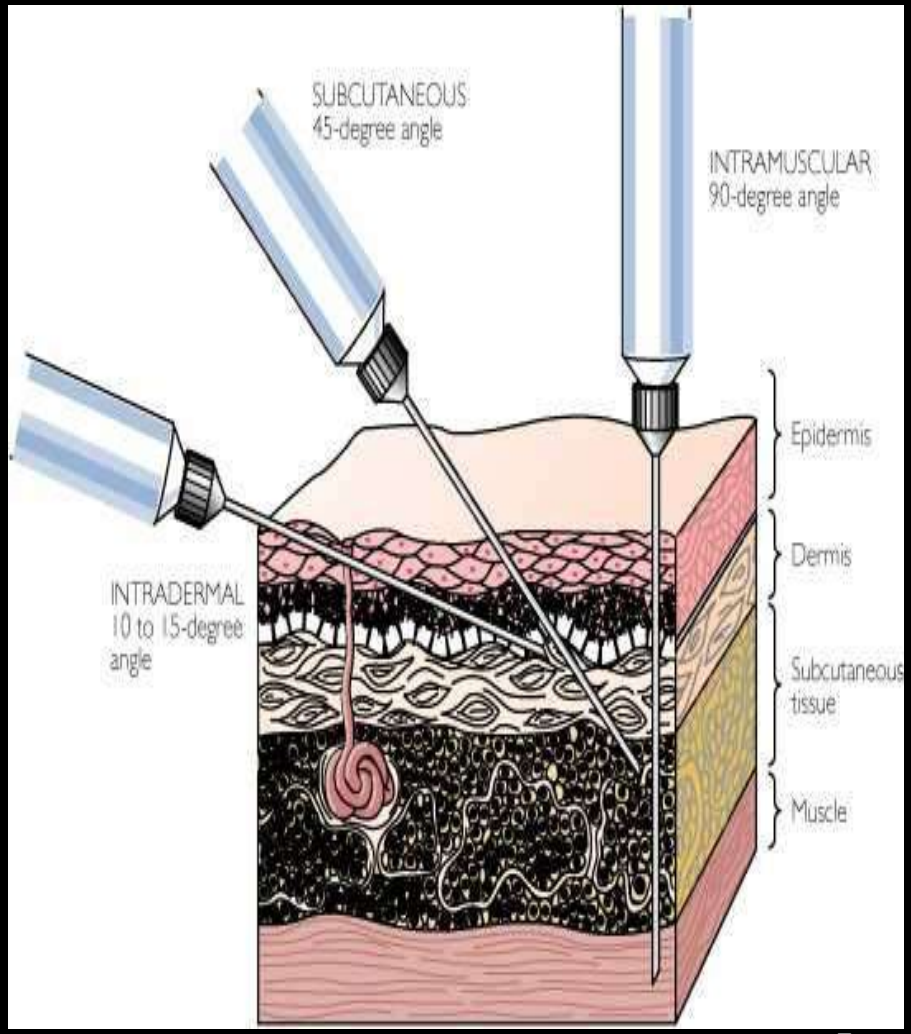
- GI specific drugs



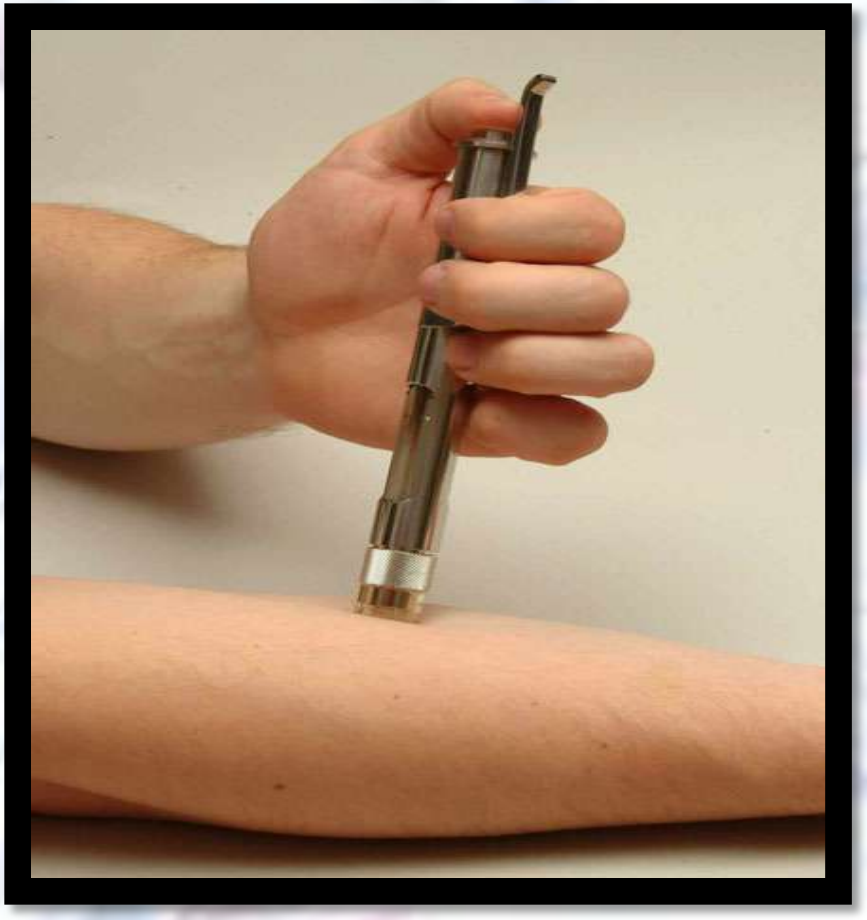
Hydrogels: (a)hydrogel preparation (b) After imbibition

Injection based Drug delivery system

- Provide fast systemic effects bypassing first-pass metabolism
- Drugs can be administered in unconscious or comatose patients
- Drugs having short half-life can be infused continuously

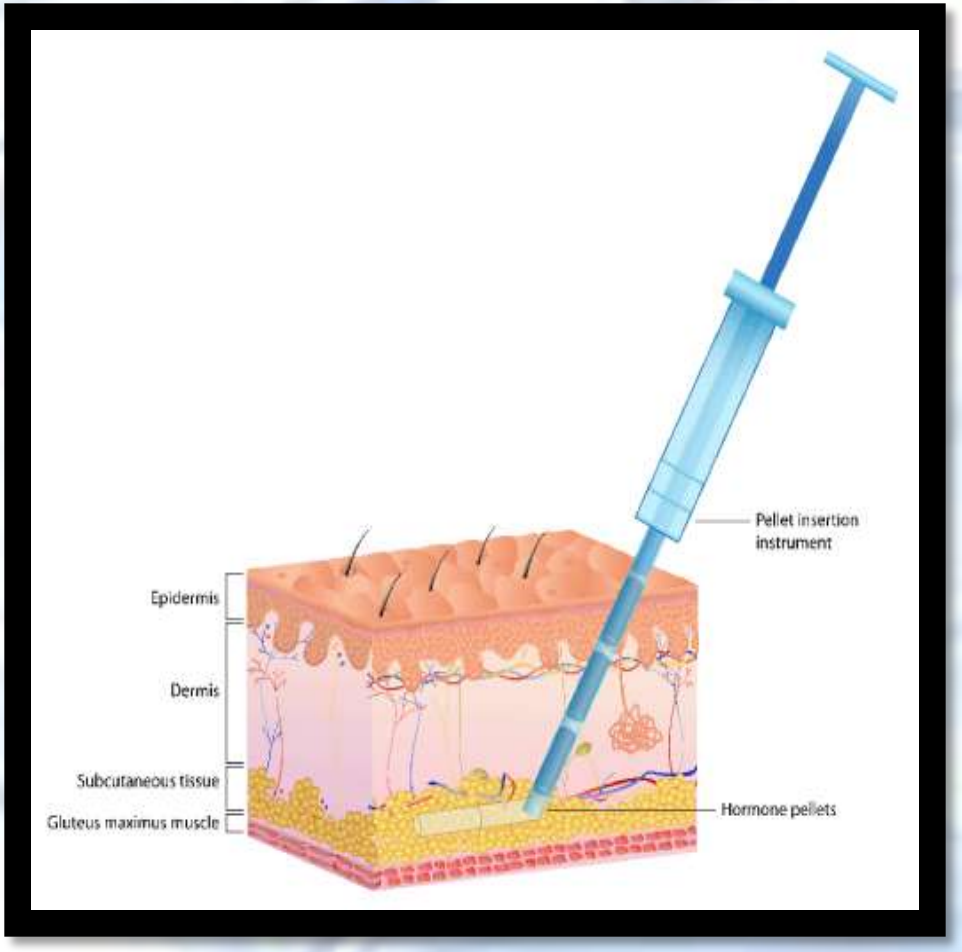


Dermojet



It is a sub-cutaneous needleless injection used for mass inoculation

Pellet implantation



Drug as a solid pellet is implanted under the skin to provide uniform systemic effect .Eg:testosterone

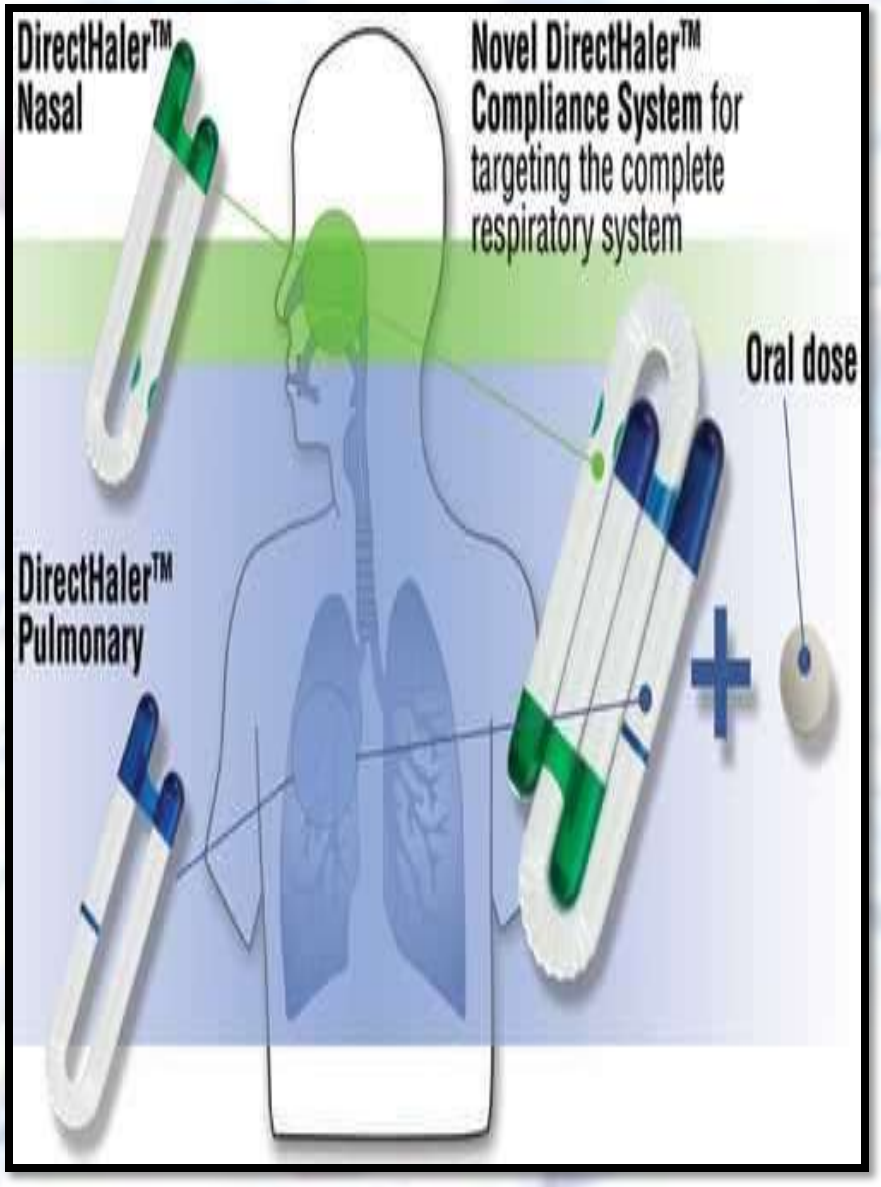
Intra-dermal injection

Insulin pen

The amount of drug given is small and the absorption is slow.Eg:BCG vaccine

Inhalation/Pulmonary Drug delivery system

- Inspiration through the nose or mouth
- Alveolar epithelium offers good surface area especially for lipid -soluble drugs
- The drugs are also excreted by this route

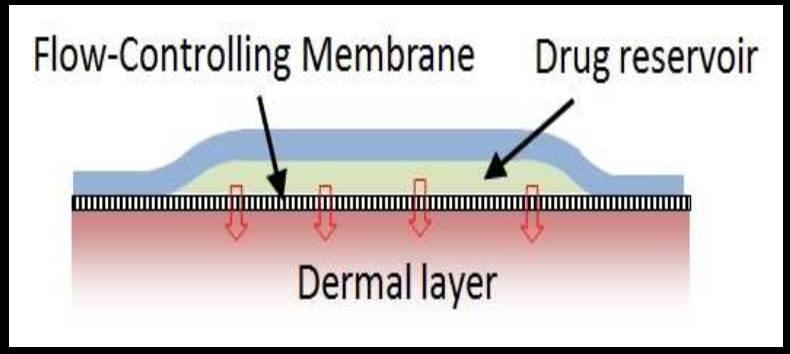


Metered dose inhaler

Dry powder inhalers

Transdermal Drug delivery system

- Adhesive patches containing the drug are applied on the skin
- The drug crosses the skin surface by diffusion by percutaneous absorption and goes into systemic circulation
- Bypasses first-pass hepatic inactivation



Transderm-SCOP (Scoplamine)
Used for motion sickness

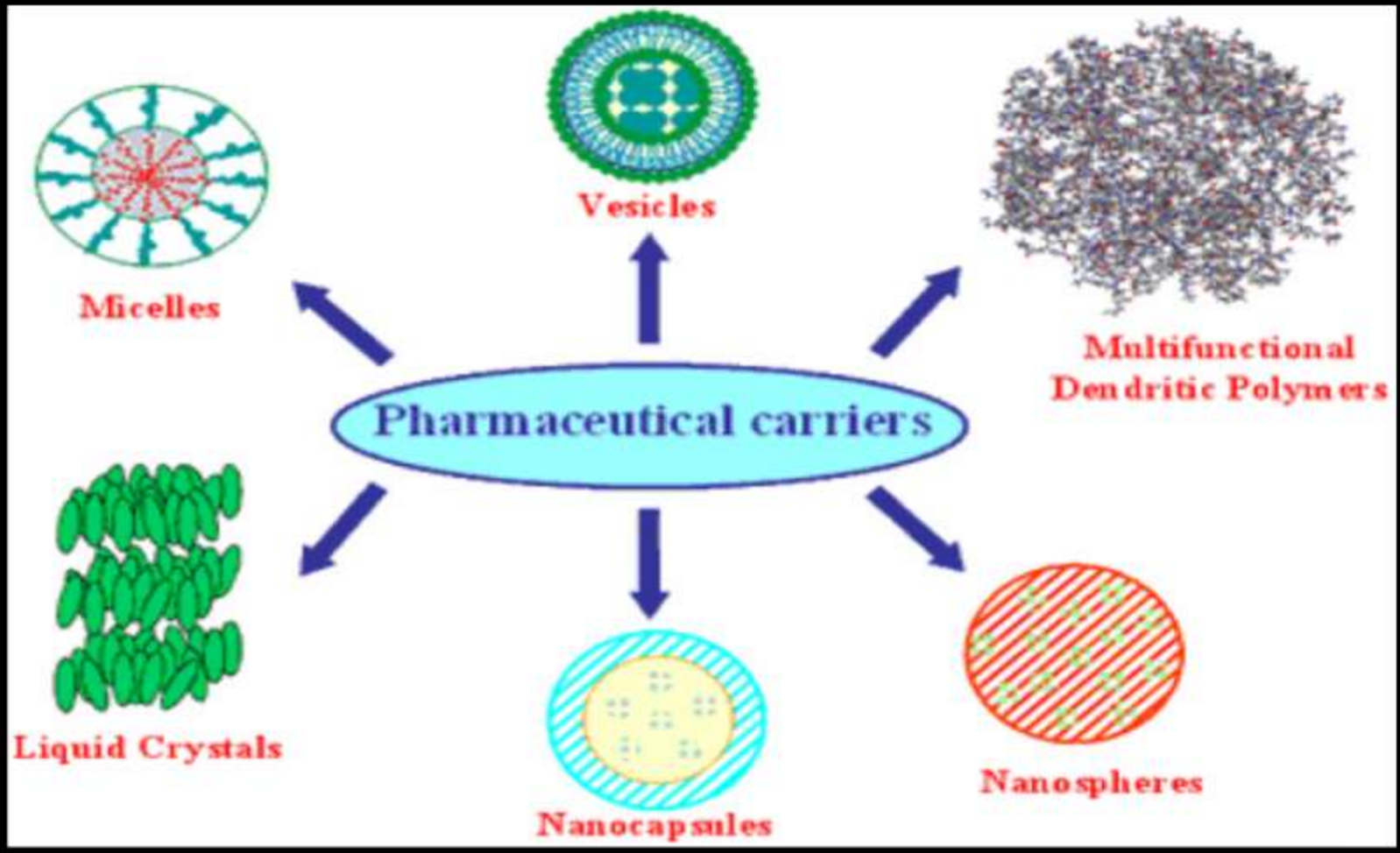
Hydrogel transdermal patch:
Used in treatment of burns

Targeted drug delivery

Developments in drug delivery systems

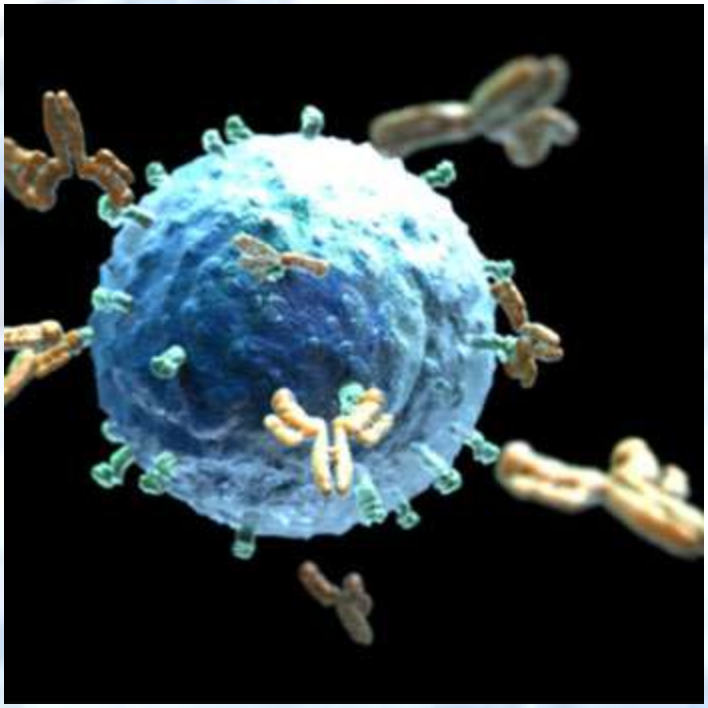
Completion of the Human Genome Project in 2001 yielded a minimum of 30 000 potential drug targets, although the function of many of these genes remains unknown. In the future, drugs may be designed according to individual genotypes, thereby enhancing safety as well as efficacy

Carrier based drug delivery system

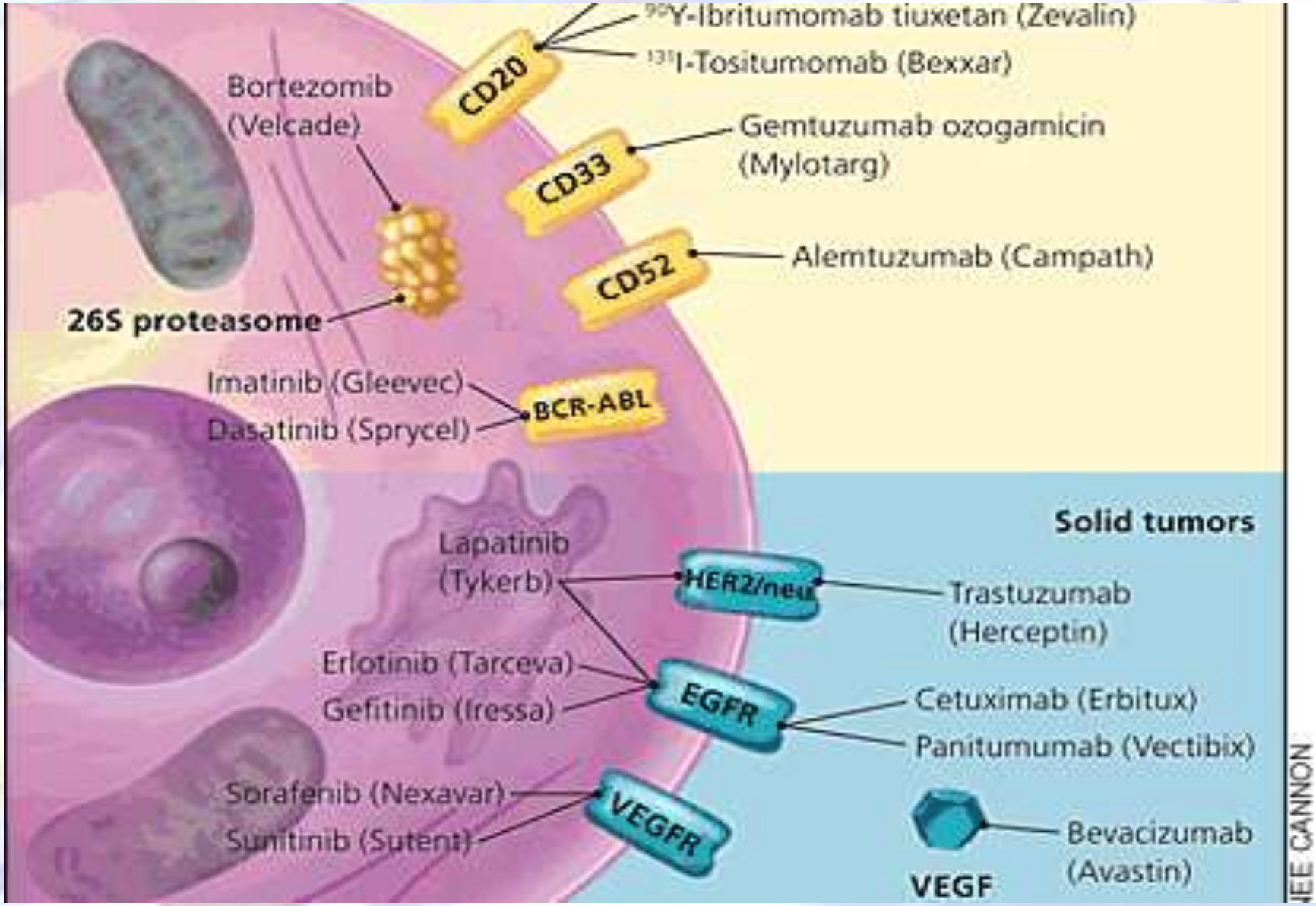


Monoclonal antibodies

- mAbs act directly when binding to a cancer specific antigen and induce immunological response to cancer cells
- mAbs was modified for delivery of a toxin, cytokine or other active conjugates



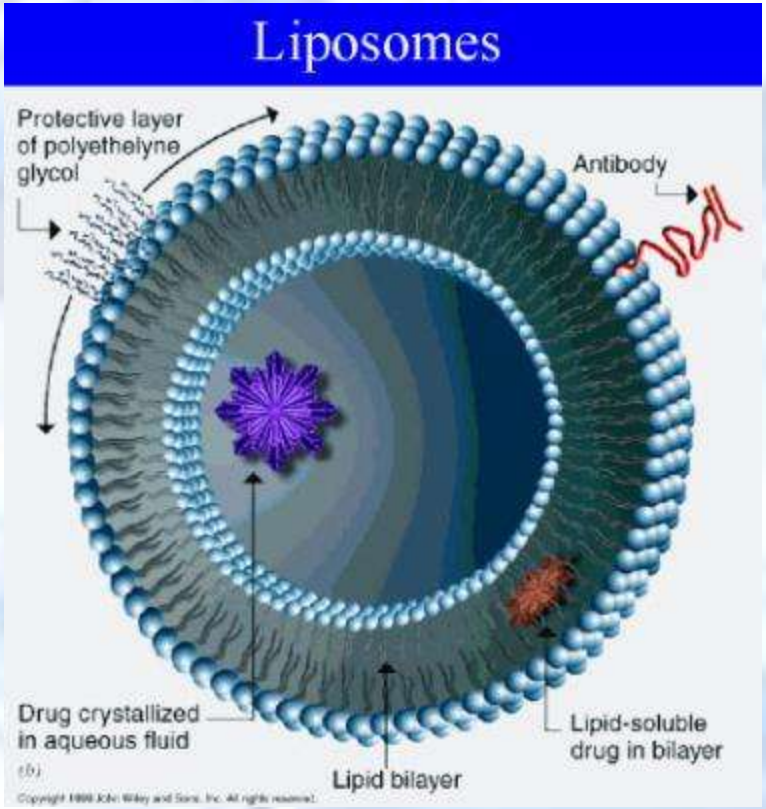
monospecific antibodies that are the same because they are made by identical immune cells that are allclones of a unique parent cell, Monoclonal antibodies havemonovalent affinity, in that they bind to the same epitope.



Monoclonal antibodies & their targets

Liposomal Drug delivery

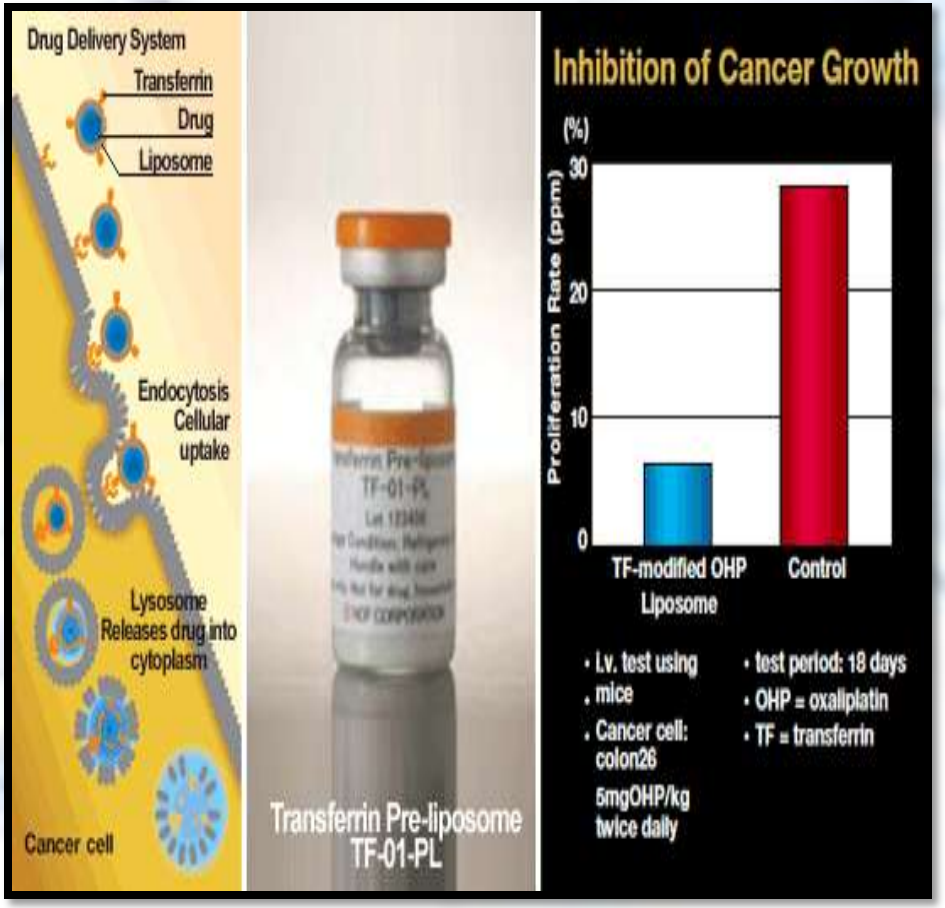
- Pre-clinical and clinical liposomal packed drugs exhibit reduced toxicities with enhanced efficiency
- Due to altered pharmacokinetics-drug accumulation at disease sites and reduced distribution to sensitive tissue-target delivery of drugs

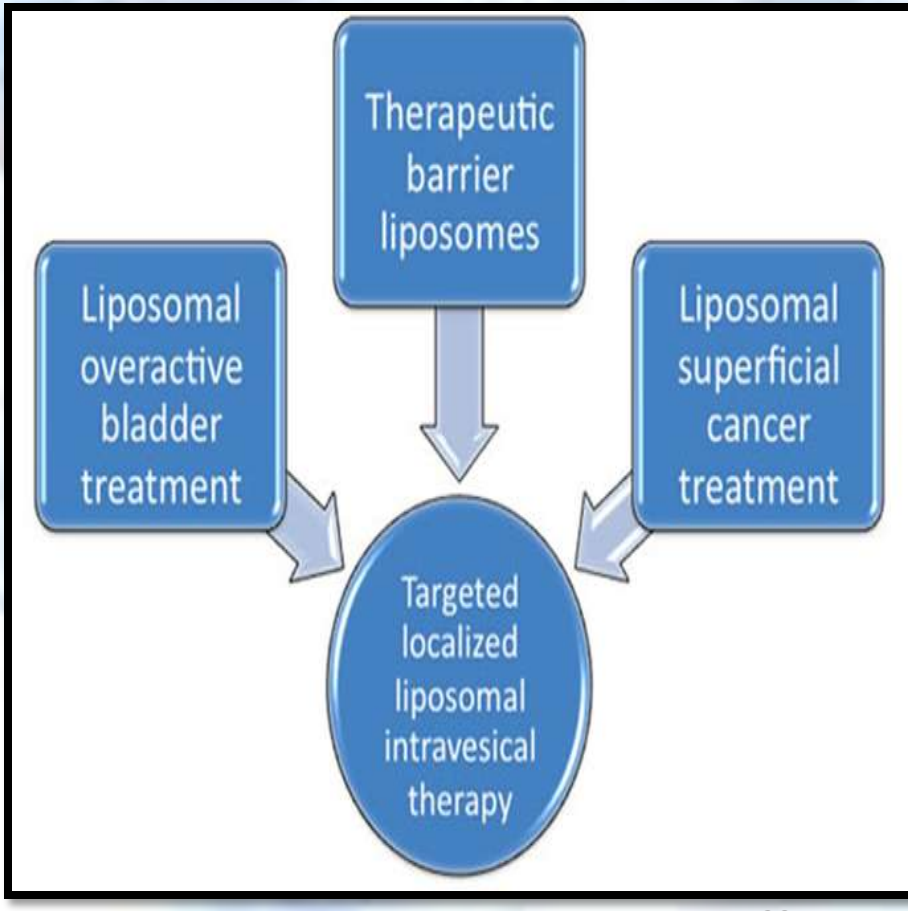


Liposomes are self-assembling closed colloidal structures composed of lipid bilayers and have a spherical shape in which an outer lipid bilayer surrounds a central aqueous space.Syn from cholesterol

Liposomal Amphotericin B – treatment of systemic Candida albicans or Cryptococcus neoformans

This formulation showed a satisfactory drug loading for ISONIAZID & PYRAZINAMID

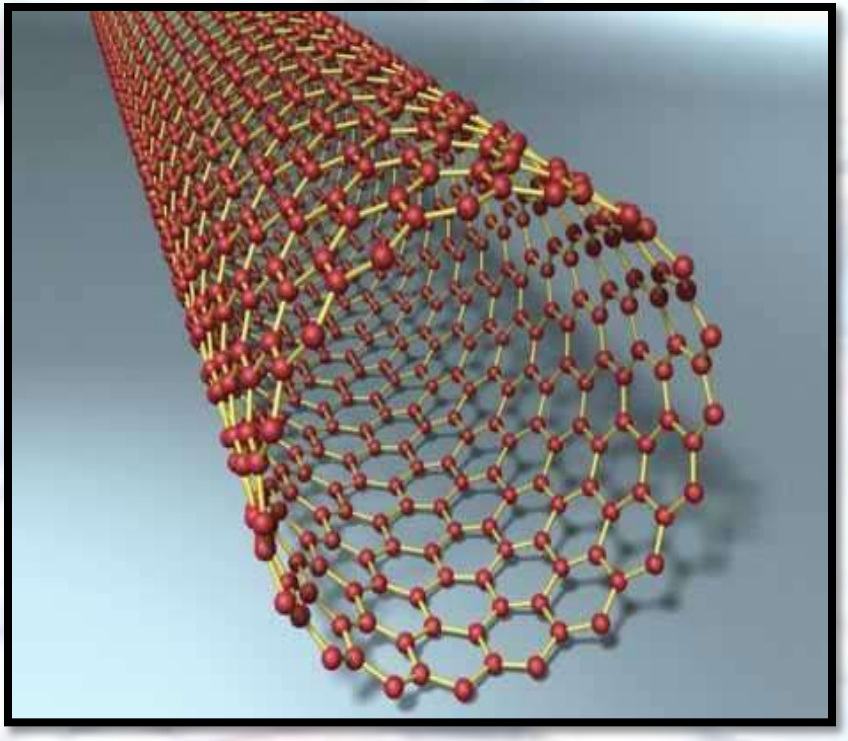




Nanoparticle based drug delivery

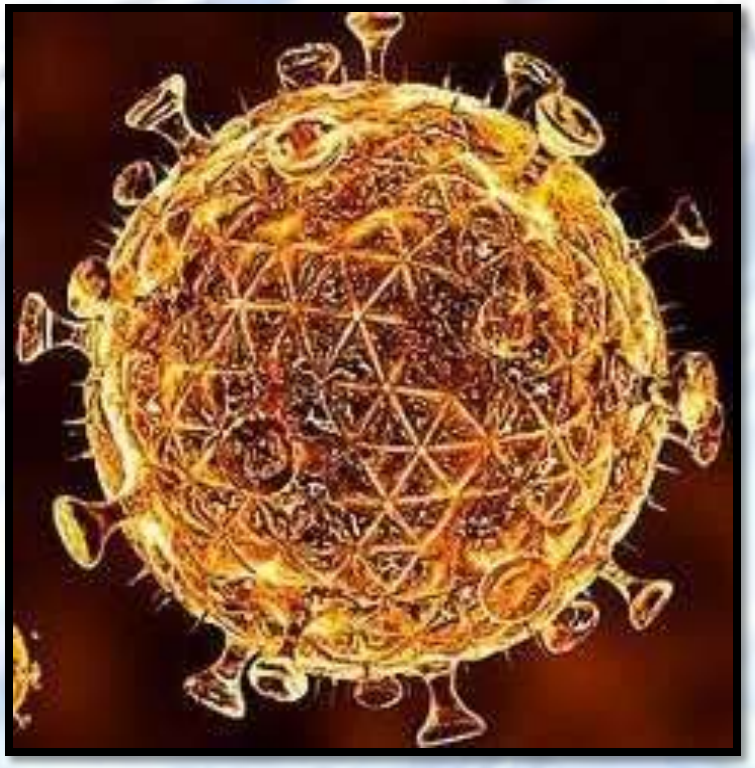
- Using nanotechnology the drug can be targeted to a precise location which would make the drug much more effective & reduce the chances of possible side-effects
- More specific drug targeting & delivery
- Reduction in toxicity while maintaining therapeutic efficiency
- Nanocarriers- Nanoparticles,Nanotubule,Nanoshell

Carbon Nanotubules



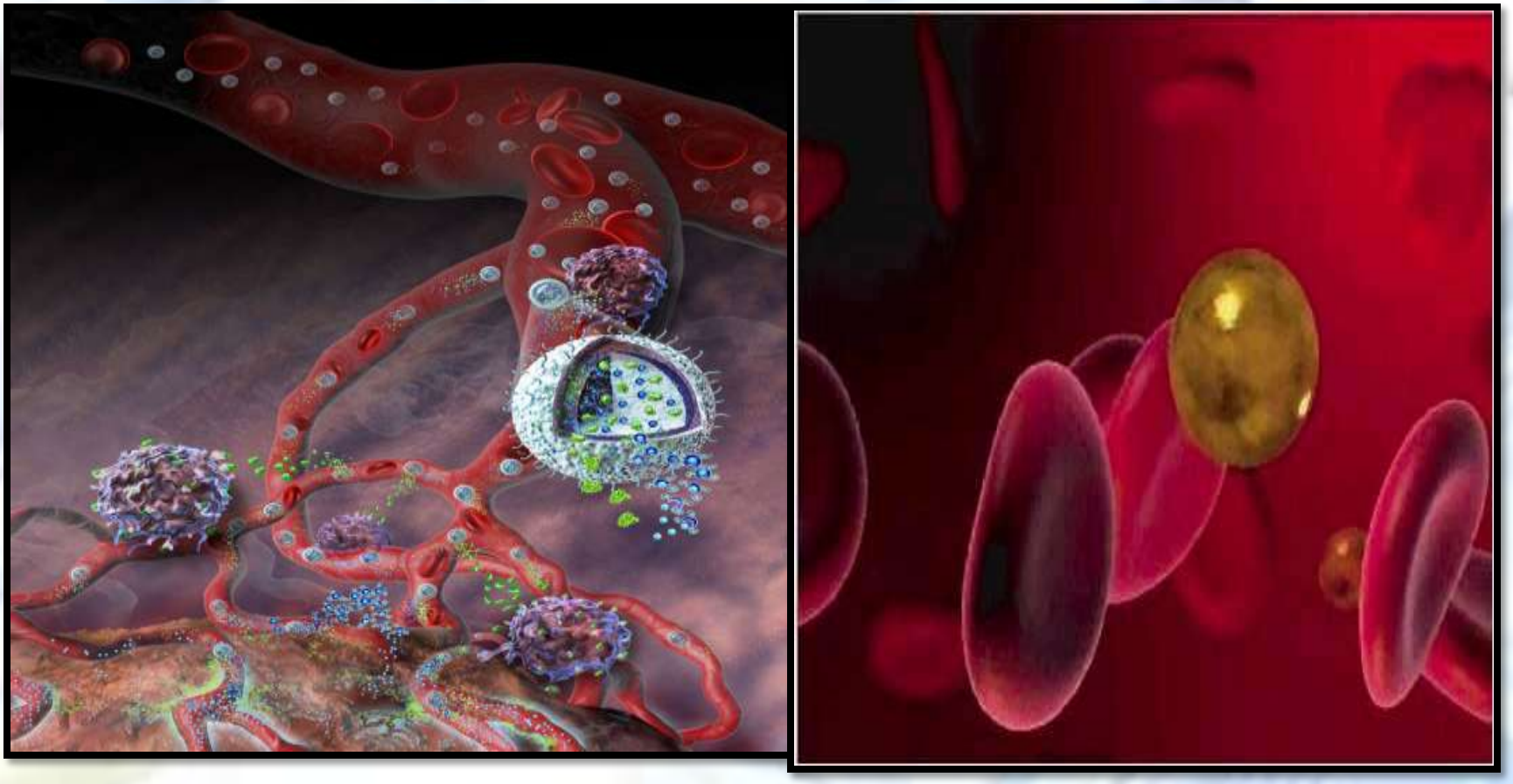
Used in treatment of Bronchial asthma
ADR:Foreign body granuloma and intestitial fibrosis

Gold Nanoparticles



Cancer chemotherapy
-free radical generation

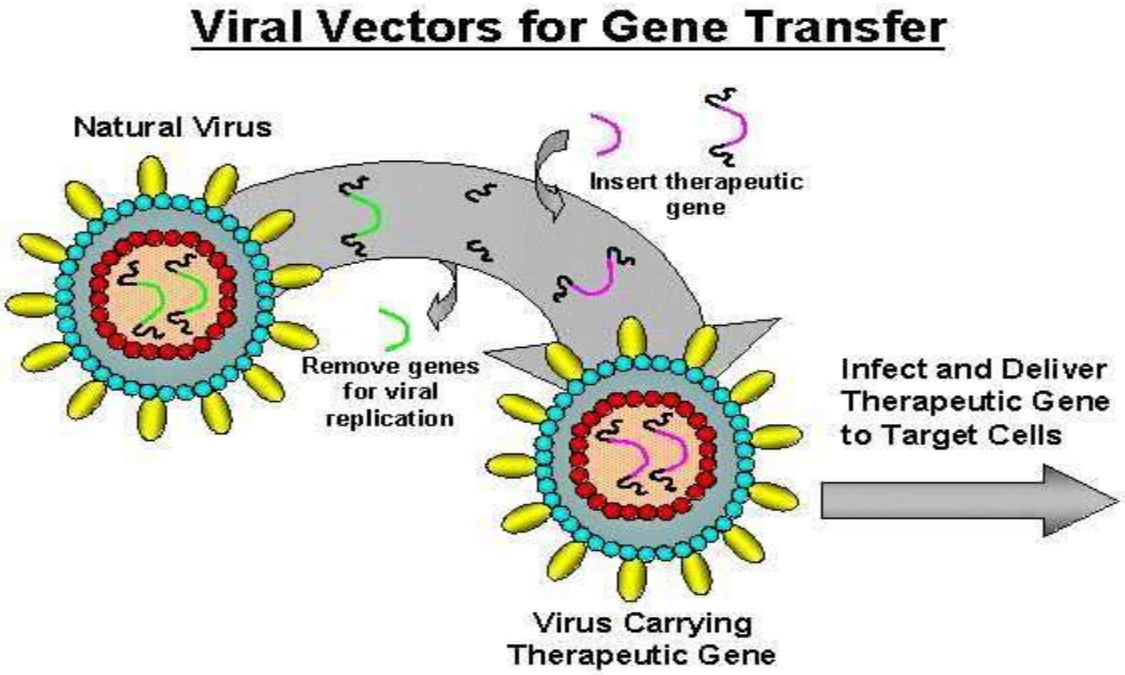
Nanoerythrosomes



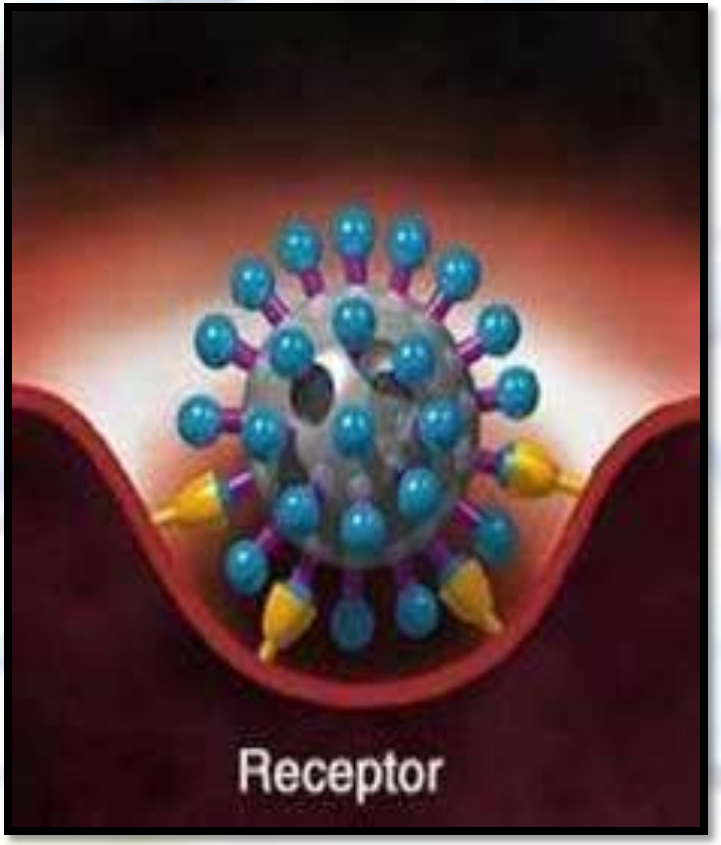
Nanoerythrosomes are resealed erythrocytes that can carry proteins ,enzymes & macromolecules.They are used in the treatment of liver tumor,parasitic disease & enzyme disease

GENETIC TRANSFER SYSTEM

- Under evaluation & III Phase clinical trials for Adenovirus & HIV

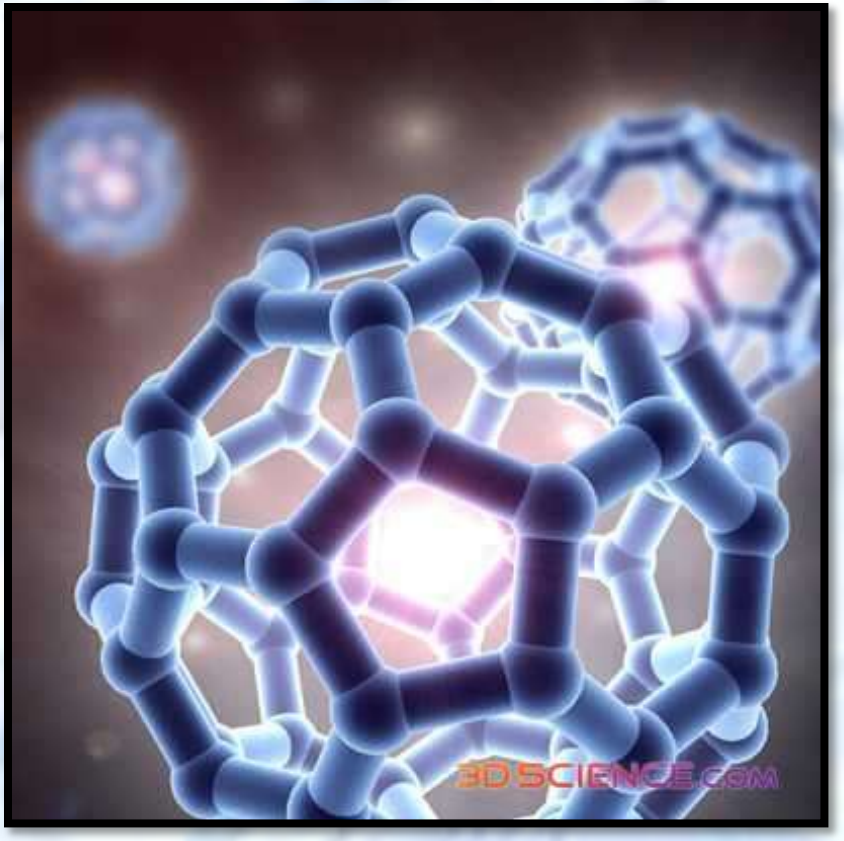


Dendrimer



Dendrimer-highly branched globular Biodegradable synthetic molecule.

Modified Buckyball



They deliver radioactive atoms to cancerous material.Eg:C-60 against CA colon
Transfer of radiation is within the ball hence minimise strong radiation to healthy tissue

Future oppurtunities

Nanoparticles provide massive advantages regarding drug targeting,delivery with additional potential to combine diagnosis and therapy

Anti-tumour therapy ,gene therapy ,AIDS therapy,radiotherapy

Involved in delivery of virostatics,vaccines and as vesicles to pass blood brain barrier


Thank You
nanoschematic