

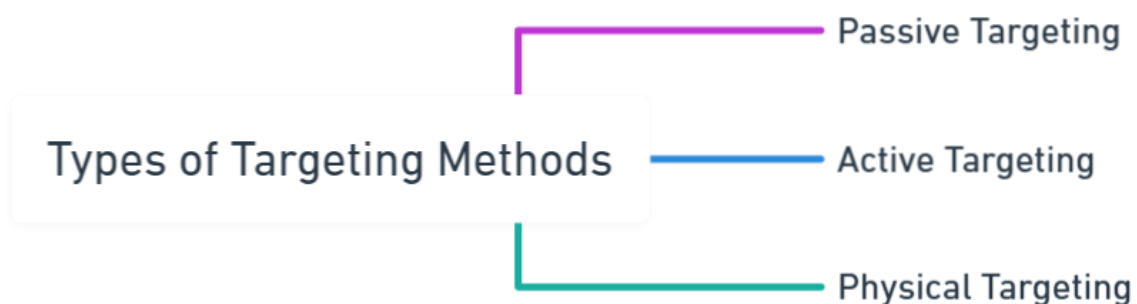
Targeting Methods

Targeting Methods

Introduction

- **Targeting** methods are the different approaches used to deliver drugs specifically to a desired site in the body.
- These methods are a key part of targeted drug delivery systems and help ensure that the drug acts mainly on diseased tissues while minimizing effects on healthy tissues.
- **The main idea behind targeting methods is based on:**
 - Differences between healthy and diseased tissues
 - Presence of specific receptors on target cells
 - Unique physiological conditions such as pH, temperature, or blood supply
 - By using these differences, drugs can be guided or directed toward a particular organ, tissue, or cell type.
- **Targeting methods improve:**
 - Drug effectiveness
 - Safety of treatment
 - Patient outcomes

Types of Targeting Methods



1. Passive Targeting

- Passive targeting uses the natural characteristics of the body to deliver drugs.
- **Example:**
 - Tumor tissues have leaky blood vessels (EPR effect), allowing nanoparticles to accumulate.
- **Key features:**
 - No need for special ligands
 - It depends on blood flow and tissue permeability
 - Common in cancer treatment

2. Active Targeting

- Active targeting uses specific ligands attached to drug carriers.
- These ligands bind to receptors on target cells, leading to selective drug delivery.
- **Examples of ligands:**
 - Antibodies
 - Peptides
 - Sugars
 - Vitamins
- **Process:**
 - Ligand binds to receptor
 - Complex enters cell via endocytosis
 - Drug is released inside the cell

3. Physical Targeting

- This method uses external physical forces or internal stimuli.
- **Examples:**
 - Magnetic targeting (using magnetic fields)
 - pH-sensitive systems (tumor environment is acidic)
 - Temperature-sensitive delivery

Preparation of Targeted Drug Delivery Systems

- Preparation involves designing and formulating a system that can carry the drug and deliver it to the target site.

Selection of Drug

- The drug should be suitable for targeting.
- **Important factors include:**
 - Stability
 - Solubility
 - Dose requirement
 - Sensitivity to enzymes or pH

Selection of Carrier

- **Carriers are chosen based on:**

- Size and shape
- Biocompatibility
- Ability to carry the drug
- Controlled release properties
- **Common carriers:**
 - Nanoparticles
 - Liposomes
 - Microspheres
 - Dendrimers

Drug Loading

- **The drug is incorporated into the carrier by:**
 - Encapsulation (drug inside carrier)
 - Adsorption (drug on surface)
 - Chemical conjugation (drug bonded to carrier)

Surface Modification

- To achieve targeting, the surface of the carrier is modified.
- **Examples:**
 - Attaching ligands (antibodies, peptides, folate)
 - PEGylation to increase circulation time
 - Adding charge or hydrophilic coatings

Formulation Techniques

- **Different techniques are used depending on the carrier type:**
 - Emulsification
 - Solvent evaporation
 - Nanoprecipitation
 - Spray drying
 - Thin film hydration (for liposomes)

Evaluation of Targeted Drug Delivery Systems

Evaluation ensures that the system works effectively and safely.

1. Particle Size and Size Distribution

- Measured using dynamic light scattering
- Size affects distribution and targeting ability
- Smaller particles circulate longer

2. Surface Charge (Zeta Potential)

- Indicates stability of particles
- High zeta potential prevents aggregation

3. Drug Loading Efficiency

- Amount of drug successfully incorporated into carrier
- Higher loading is preferred

4. Drug Release Studies

- Determines how the drug is released over time
- Performed in simulated biological fluids

5. Stability Studies

- Checks of physical and chemical stability during storage

6. In Vitro Studies

- Performed in laboratory conditions using cells
- Evaluate cellular uptake and toxicity

7. In Vivo Studies

- Conducted in animal models
- Assess distribution, targeting efficiency, and therapeutic effect

8. Targeting Efficiency

- Measures how much drug reaches the target site
- Compared with non-targeted systems



Particle Size



Surface Charge



Drug Loading Efficiency



Drug Release Studies



Stability Studies



In Vitro Studies



In Vivo Studies



Targeting Efficiency

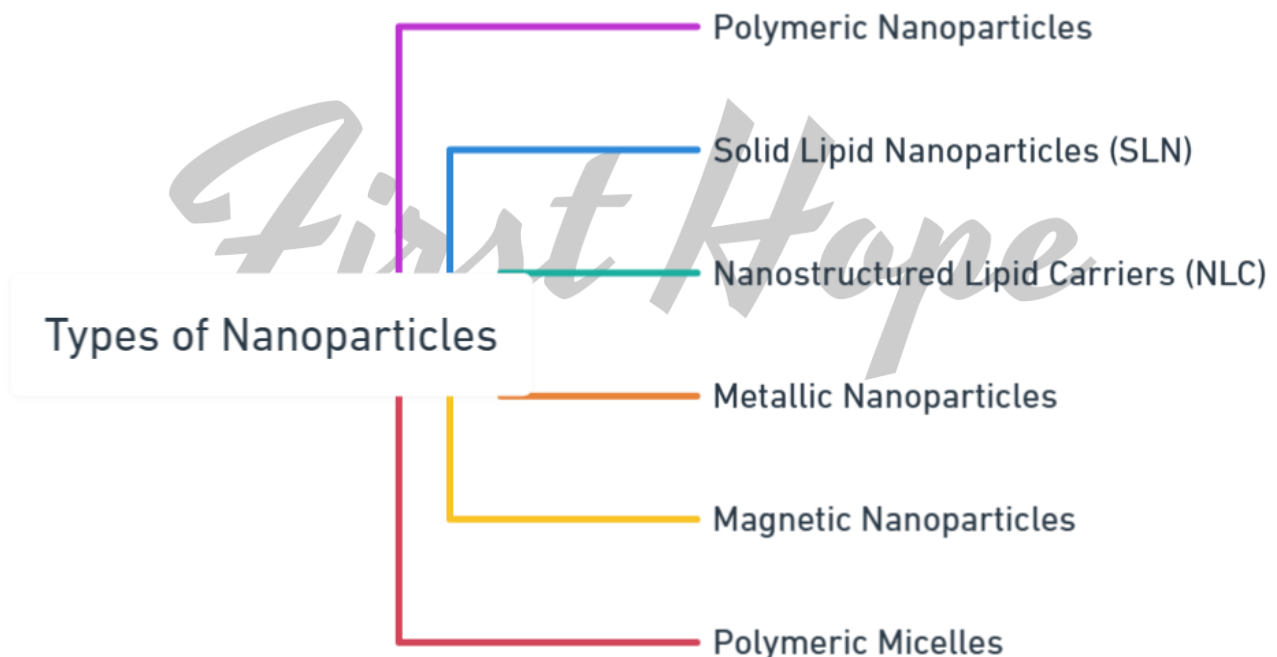
Nano-Particles & Liposomes

Nanoparticles

Introduction

- Nanoparticles are very small particles with sizes ranging from 1 to 1000 nanometers.
- They are widely used as drug carriers because of their small size and large surface area.
- **They can:**
 - Improve drug solubility
 - Protect drugs from degradation
 - Provide controlled drug release
 - Enhance targeting specific tissues

Types of Nanoparticles



1. Polymeric Nanoparticles

- Made from biodegradable polymers.
- **Types:**
 - Nanospheres (drug uniformly dispersed)
 - Nanocapsules (drug enclosed in a cavity)
- **Examples of polymers:**
 - PLGA (poly lactic-co-glycolic acid)
 - Chitosan

2. Solid Lipid Nanoparticles (SLN)



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