Targeting Methods

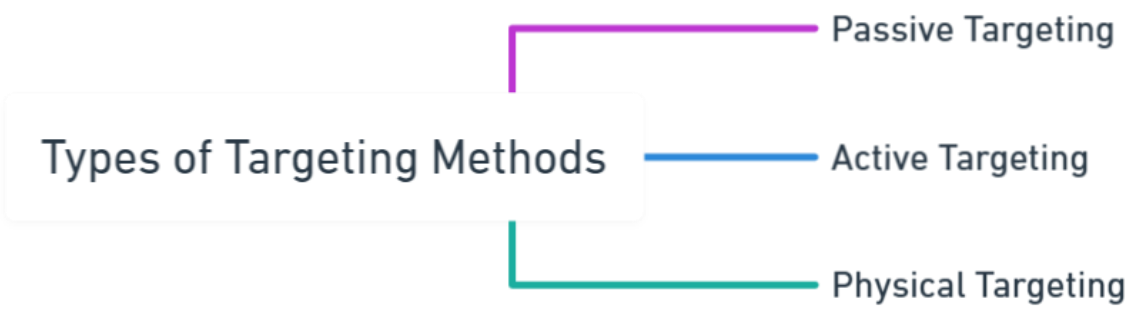
Targeting Methods

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

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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

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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

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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:**

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- Size and shape
- Biocompatibility
- Ability to carry the drug
- Controlled release properties

- **Common careers:**
  - 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

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- 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



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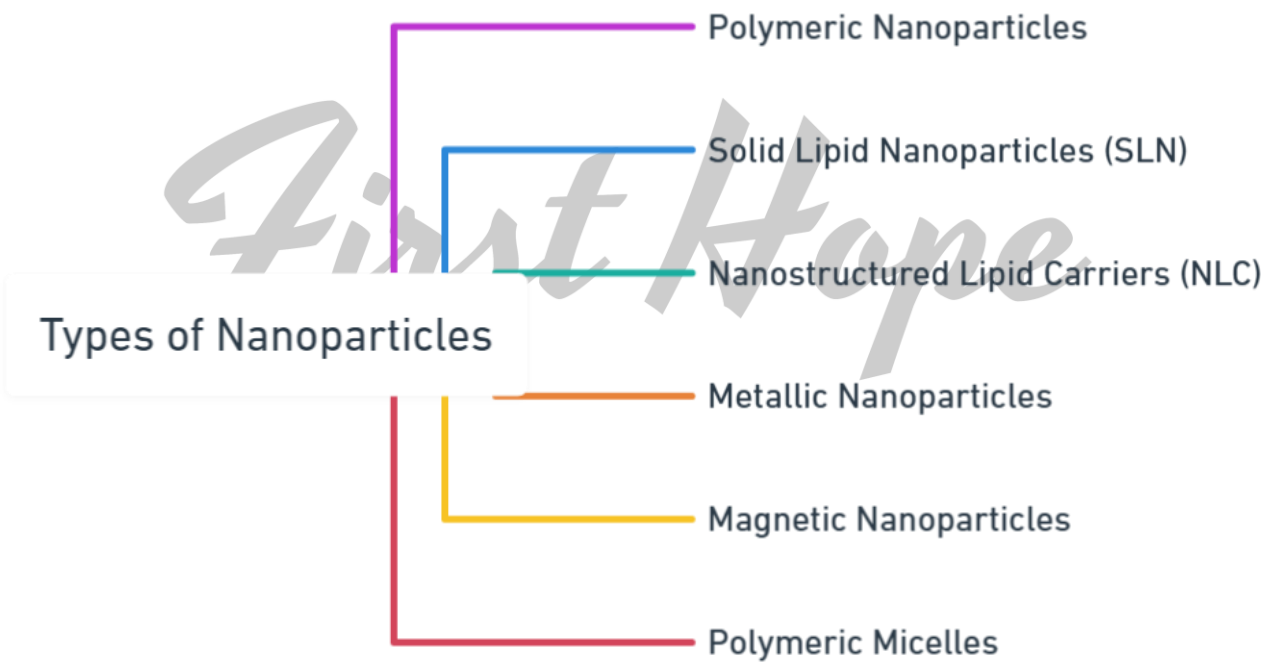
Nano-Particles & Liposomes

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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