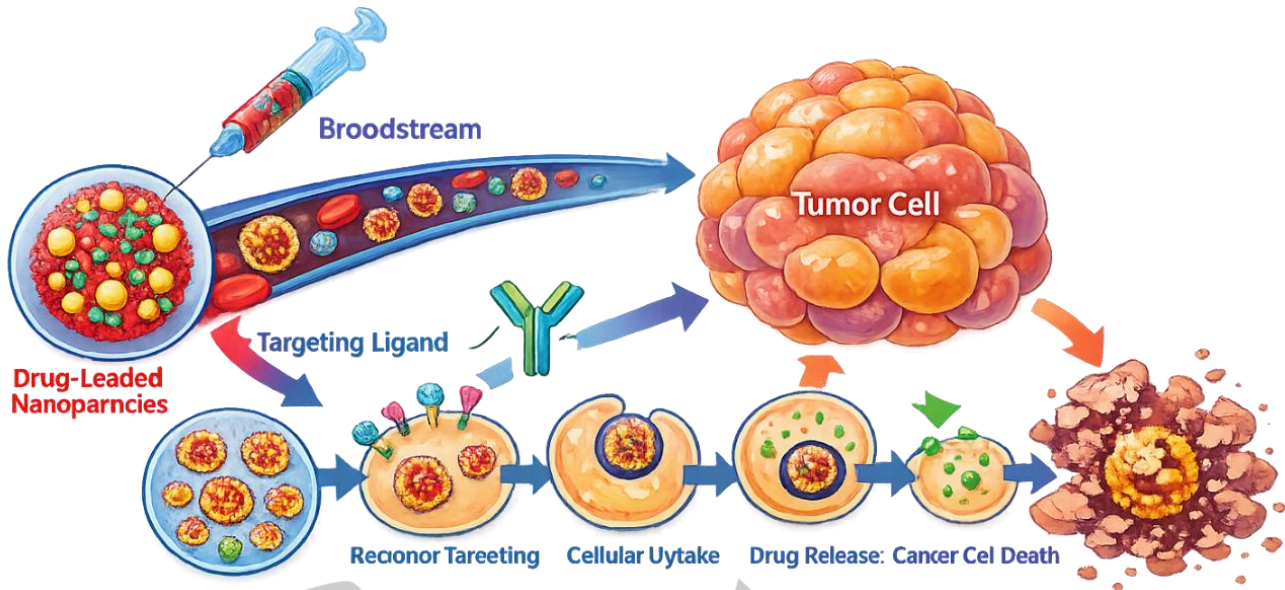


Targeted Drug Delivery

Targeted Drug Delivery

- Targeted drug delivery enhances therapeutic efficacy by directing medications to specific cells or tissues, minimizing side effects compared to traditional systemic administration.



Key Concepts

- Selective Targeting:** Directing drugs specifically to disease sites (e.g., tumors, inflamed tissues).
- Controlled Release:** Sustaining drug release at the target site over time.
- Reduced Systemic Exposure:** Limiting drug interaction with non-target tissues to minimize adverse effects.

Approaches to Targeted Drug Delivery

- Passive Targeting:** Exploits physiological differences in diseased tissues (e.g., Enhanced Permeability and Retention (EPR) effect in tumors).
- Active Targeting:** Modifies drug carriers with ligands (e.g., antibodies, peptides) to bind specific receptors on target cells.
- Stimuli-Responsive Systems:** Activates drug release in response to local triggers like pH, temperature, or enzymes.
- Physical Targeting:** Uses external forces (e.g., magnetic fields, ultrasound) to guide drug carriers to specific sites.

Advantages of Targeted Drug Delivery

- Increased Efficacy:** Higher drug concentrations at the target site enhances therapeutic outcomes.
- Reduced Side Effects:** Minimizes drug exposure to non-target tissues, lowering adverse effects.

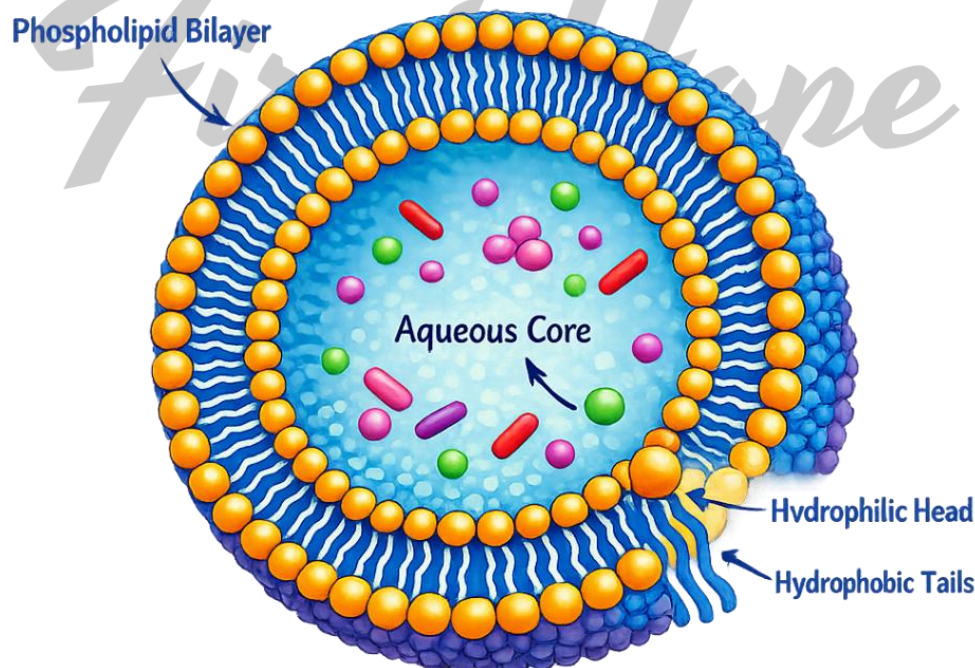
- **Improved Patient Compliance:** Enables lower dosages and less frequent administration.
- **Enhanced Stability:** Protects drugs from degradation before reaching the target.
- **Controlled Release:** Maintains therapeutic levels over extended periods.

Disadvantages of Targeted Drug Delivery

- **Complex Design:** Requires intricate engineering and biological insights.
- **High Cost:** Expensive production increases treatment costs.
- **Immunogenicity Risk:** Certain ligands or carriers may trigger immune responses.
- **Limited Penetration:** Challenges in reaching deep tissues or solid tumors.
- **Regulatory Barriers:** Novel systems face stringent approval processes.

Liposomes

- Liposomes are tiny spherical vesicles widely used as delivery systems for bioactive molecules.
- Formed by hydrating lipid molecules in an aqueous environment, they resemble cell membranes, making them biocompatible and suitable for interaction with human cells.



Structural Composition

- **Core and Bilayer:** An aqueous core surrounded by one or multiple concentric lipid bilayers.
- **Phospholipids:** Composed of amphiphilic phospholipids, with hydrophilic "heads" facing outward and hydrophobic "tails" inward.
- **Organization:** Bilayers naturally form due to the amphiphilic nature of phospholipids.

Types of Liposomes



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