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Recently published articles

1. Factors Involved in the biochemical etiology of human seminal plasma hyperviscosity
2. Percutaneous drug delivery systems for improving antifungal therapy effectiveness.
3. Pharmaceutical optimization of lipid-based dosage forms for the improvement of taste-masking, chemical stability and solubilizing capacity of phenobarbital.
4. Development, characterization and in vitro evaluation of tamoxifen microemulsions
5. Solubility of amphotericin B in water-lecithin-dispersions and lecithin-based submicron emulsions.
7. Polyphenols and antimicrobial activity in extracts of *Lippia alba* (Mill.).
8. An antibody recognizing the apical domain of human transferrin receptor 1 efficiently neutralizes all New World hemorrhagic fever arenaviruses.
Principles of Drug Delivery
Drug Delivery

- **Definition**
  - The appropriate administration of drugs through various routes in the body for the purpose of improving health
  - It is highly interdisciplinary
  - It is not a young field
  - It has recently evolved to take into consideration
    - Drug physico-chemical properties
    - Body effects and interactions
    - Improvement of drug effect
    - Patient comfort and well being

Controlled Drug Delivery
Oral Administration

**Advantages**
- Patient: Convenience, not invasive, higher compliance
- Manufacture: well established processes, available infrastructure

**Disadvantages**
- Unconscious patients cannot take dose
- Low solubility
- Low permeability
- Degradation by GI enzymes or flora
- First pass metabolism
- Food interactions
- Irregular absorption
Oral Administration

• Traditional oral delivery systems
  • Tablets
  • Capsules
  • Soft gelatin capsules
  • Suspensions
  • Elixirs
Buccal/Sublingual

**Advantages**
- By-pass First pass metabolism
- Rapid absorption
- Low enzymatic activity

**Disadvantages**
- Discomfort during dissolution
- Probability of swallowing—lost of effect
- Small doses

**Traditional delivery system/devices**
- Tablets
- Chewing gum
Rectal

• Advantages
  • By-pass first pass metabolism
  • Useful for children

• Disadvantages
  • Absorption depends on disease state
  • Degradation by bacterial flora
  • Uncomfortable

• Traditional delivery system/devices
  • Suppository
  • Enema
Intravenous (IV)

**Advantages**
- Drug 100% bioavailable
- Rapid response
- Total control of blood concentration
- Maximize incorporation of degradable drugs
- By-pass FPM

**Disadvantages**
- Invasive
- Trained personnel
- Possible toxicity due to incorrect dosing
- Sterility

**Traditional delivery system/devices**
- Injection-bolus
- IV bag - infusion
Subcutaneous

- Advantages
  - Patient self-administration
  - Slow, complete absorption
  - By-pass FPM

- Disadvantages
  - Invasive
  - Irritation, inflammation
  - Maximum dose volume - 2mL
Intramuscular

- Advantages
  - Patient can administer the drug himself
  - Larger volume than subcutaneous
  - By-pass first pass metabolism

- Disadvantages
  - Invasive – patient discomfort
  - Irritation, inflammation
  - May require some training
Inhalers

• Advantages
  • By-pass FPM
  • Gases are rapidly absorbed

• Disadvantages
  • Solids and liquids can be absorbed if size is below 0.5um
Transdermal

• Advantages
  • Local effect
  • Ease of administration

• Disadvantages
  • Low absorption for some drugs
  • May cause allergic reactions

• Requirements
  • Low dosage <10 mg/mL
  • MW< 1,000
Factors Influencing the Selection of the Delivery Route

• Drug physico-chemical properties
  • Drug molecular size (molecular weight)
  • Half-life
  • Chemical stability
  • Loss of biological activity in aqueous solution
    • Proteins
      • Denaturation, degradation
Factors Influencing the Selection of the Delivery Route

• Solubility in aqueous solution (hydrophobicity/hydrophilicity)
  • pH
  • pKa - ionization
  • Temperature
  • Concentration
  • Crystalinity
  • Particle size
  • State of hydration
Factors Influencing the Selection of the Delivery Route

- Drug biological interactions
  - Sensitive to FPM
- Low membrane permeabiltiy
  - Efflux pumps (MRP, MDR) – cancer drugs
  - Hydrophilicity
  - High-density charge
- Enzymatic degradation
- Bacterial degradation
- Half-life
- Side effects
  - Irritation
Factors Influencing the Selection of the Delivery Route

- Desired pharmacological effect
  - Local
    - topical, vaginal
  - Systemic
    - oral, buccal, IV, SC, IM, rectal, nasal
- Immediate response
  - IV, SC, IM, nasal
- Dose size
- Drug molecular size
Pharmacokinetics and Pharmacodynamics

Design of dosage regimen
- Where?
- How much?
- How often?
- How long?

Plasma Concentration

Effects
Plasma refers to the clear supernatant fluid that results from blood after the cellular components have been removed.
Plasma Concentration

![Graph showing plasma concentration over time with therapeutic window and toxicity levels.]

- Plasma concentration (mg/mL)
- Time (min)
- Therapeutic window
- Toxicity
- No therapeutic effect
Oral Administration

Intravenous Injection

Intramuscular Injection

Subcutaneous Injection

Gastrointestinal Tract

Circulatory System

Tissues

Metabolic Sites

Excretion
Absorption of drugs could vary within different administration routes

- 500 mg dose given
  - intramuscularly
  - orally
**to the same subject on separate occasions**

- Biological barriers greatly affect the extent of drug absorption
Journal of Nanomedicine & Biotherapeutic Discovery

- Journal of Nanomedicine & Biotherapeutic Discovery
- Journal of Nanomedicine & Nanotechnology
Journal of Nanomedicine & Biotherapeutic Discovery

- International Conference on Nanotek & Expo
- International Conference on Signal Processing
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