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Commentary

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Drug Absorption

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Description

Drug absorption is decided by the drug's physicochemical properties, formulation, and route of administration. Dosage forms (eg: tablets, capsules, solutions), consisting of the drug plus other ingredients, are formulated to tend by various routes (eg: oral, buccal, sublingual, rectal, parenteral, topical, inhalational).

The membranes are composed primarily of a bimolecular lipid matrix, which determines membrane permeability characteristics. Drugs may cross cell membranes by:

- Passive diffusion
- Facilitated passive diffusion
- Active transport

Passive diffusion

Drugs diffuse across a cell wall from a neighbourhood of high concentration (eg: gastrointestinal fluids) to at least one of low concentration (eg: blood). Diffusion rate is directly proportional to the gradient but also depends on the molecule's lipid solubility, size, degree of ionization, and therefore the area of absorptive surface.

Facilitated passive diffusion

Certain molecules with low lipid solubility (eg: glucose) penetrate membranes sooner than expected. One theory is facilitated passive diffusion: A carrier molecule within the membrane combines reversibly with the substrate molecule outside the cell wall, and therefore the carrier-substrate complex diffuses rapidly across the membrane, releasing the substrate at the inside surface.

Active transport

Active transport is selective, requires energy expenditure, and should involve transport against a degree gradient. Active transport seems to be limited to drugs structurally similar to endogenous substances (eg: ions, vitamins, sugars, amino acids). These drugs are usually absorbed from specific sites within the intestine.

Oral Administration

To be absorbed, a drug given orally must survive encounters with low pH and various gastrointestinal (GI) secretions, including potentially degrading enzymes. Peptide drugs (eg: insulin) are particularly vulnerable to degradation and aren't given orally. Absorption of oral drugs involves transport across membranes of the epithelial cells in the GI tract. Absorption is affected by.

- Differences in luminal pH along the GI tract
- Surface area per luminal volume
- Blood perfusion
- Presence of bile and mucus
- The nature of epithelial membranes.

Controlled-Release Forms

Controlled-release forms are designed to scale back dosing frequency for drugs with a brief elimination half-life and duration of effect. These forms also limit fluctuation in plasma drug concentration, providing a more uniform therapeutic effect while minimizing adverse effects. Absorption rate is slowed by coating drug particles with wax or other water-insoluble material, by embedding the drug during a matrix that releases it slowly during transit through the gastrointestinal tract, or by complexing the drug with ion-exchange resins. Most absorption of those forms occurs within the intestine. Crushing or otherwise disturbing a controlled-release tablet or capsule can often be dangerous.

Drug Bioavailability

Bioavailability refers to the extent and rate at which the active moiety (drug or metabolite) enters systemic circulation, thereby accessing the site of action.

Bioavailability of a drug is largely determined by the properties of the dosage form, which depend partly on its design and manufacture. Differences in bioavailability among formulations of a given drug can have clinical significance; thus, knowing whether drug formulations are equivalent is important.

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