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Advances and Challenges in Oral Drug Delivery: Improving Bioavailability and Therapeutic Effectiveness

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DESCRIPTION

This approach is commonly used for drugs that are sensitive to gastric conditions or those that may cause irritation to the stomach lining, such as nonsteroidal anti-inflammatory drugs. In addition, nanoparticle-based carriers have shown promise in delivering peptides and proteins orally by encapsulating them in protective nanoparticles that shield them from degradation and facilitate their absorption. Another challenge associated with oral drug delivery is patient variability. Factors such as age, genetics, diet, and the presence of certain diseases can affect how a drug is absorbed, metabolized, and eliminated from the body. By tailoring drug formulations to individual patient characteristics, it may be possible to optimize therapeutic outcomes and minimize the risk of side effects. For example, pharmacogenomics, the study of how genetic variations affect drug response, can help identify patients who may require dose adjustments based on their genetic makeup. The future of oral drug delivery holds significant promise as researchers continue to explore novel technologies and strategies to enhance drug absorption and bioavailability. Dorel drug delivery is the most widely accepted and preferred method of administering therapeutic agents, primarily due to its convenience, patient compliance, and non-invasive nature. Oral formulations, whether in the form of tablets, capsules, or liquids, offer ease of administration compared to other methods like injections or infusions. Despite its popularity, oral drug delivery presents several challenges, especially in terms of bioavailability, drug stability, and targeted delivery. Overcoming these hurdles has been a key focus of pharmaceutical research, with advancements in formulation technology offering promising solutions to improve drug absorption and therapeutic outcomes. One of the primary challenges of oral drug delivery is poor bioavailability, especially for drugs with low solubility or permeability. To address these issues, pharmaceutical scientists have developed various strategies to enhance the absorption of drugs and protect them from degradation. Additionally, the development of Self-Emulsifying Drug Delivery Systems (SEDDS) has shown great promise in improving the absorption of lipophilic drugs. These systems form micro emulsions upon contact with gastrointestinal fluids, allowing the drug to be absorbed more efficiently. Another significant advancement in oral drug delivery is the use of controlled-release formulations. Controlled-release systems are designed to release the drug gradually over an extended period, maintaining therapeutic drug levels in the bloodstream for longer durations and reducing the need for frequent dosing. This is particularly beneficial for patients with chronic conditions, where sustained drug delivery is necessary to manage symptoms effectively. Controlled-release formulations can be achieved through various mechanisms, including matrix systems, reservoir systems, and osmotic pumps. By modulating the drug release rate, these systems not only improve patient adherence to treatment but also minimize the peaks and troughs in drug concentration, reducing the risk of side effects. For drugs that are unstable in the acidic environment of the stomach, enteric-coated formulations have been developed. Enteric coatings protect the drug from being degraded by stomach acid, ensuring its release only when it reaches the more neutral pH of the intestines. In addition, nanoparticles can be functionalized with targeting ligands that allow for site-specific drug delivery, ensuring that the drug reaches the intended tissues or organs with greater precision.

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CONFLICT OF INTEREST

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