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Novel and Current Efforts in Drug Delivery System

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Commentary

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DESCRIPTION

Approaches, formulations, manufacturing procedures, storage systems, and technologies used to deliver a pharmaceutical ingredient to its target site in order to accomplish a desired therapeutic effect are referred to as drug delivery. To increase efficacy and safety, as well as patient convenience and compliance, principles pertaining to drug formulation, mode of administration, site-specific targeting, metabolism, and toxicity are applied. Drug delivery aims to change a drug's pharmacokinetics and specificity by incorporating various excipients, drug carriers, and medical devices into its formulation. To improve treatment outcomes, more attention is placed on enhancing a drug's bioavailability and duration of action. Some studies have focused on enhancing the safety of the person who administers the medicine. Several types of micro needle patches, have been introduced for administering vaccines and other medications.

The Drug delivery is a term that is closely linked to dose type and method of administration, with the latter being included in some definitions. While the terms route of administration and drug delivery are frequently used interchangeably, they are two distinct ideas. Medication delivery involves the engineering of delivery systems and can include different dose forms and devices used to deliver a drug through the same route, whereas route of administration refers to the path a drug takes to enter the body. Oral, parenteral (injected), sublingual, topical, transdermal, inhaled, rectal, and vaginal are common methods of administration; however, drug delivery is not restricted to these routes, and there may be multiple ways to give drugs through each route.

Research into innovative delivery systems has been progressing since the approval of the first controlled-release formulation in the 1950s, whereas new medication discovery has been dropping. This shift in attention could be due to a number of things. The high expense of researching new medications is one of the driving forces. According to a 2013 study, the cost of developing a delivery system is only 10% that of producing a new medicine. A more recent study estimated that the median cost of bringing a new medicine to market in 2020 would be $985 million, but it did not account for the expense of producing drug delivery systems. Other variables that may have affected the rise in drug delivery system development include a greater understanding of the pharmacology, pharmacokinetics, and pharmacodynamics of many medications, as well as the rising prevalence of both chronic and infectious diseases.

Current drug delivery efforts cover a wide range of subjects, including controlled-release formulations, targeted delivery, nanomedicine, drug carriers, 3D printing, and biologic drug delivery. The delivery of a medicine to its target place without affecting adjacent tissues is known as targeted drug delivery. Because of its potential implications in the treatment of cancer and other chronic diseases, interest in targeted medication delivery has exploded. The developed system must circumvent the host's defence mechanisms and circulate to its intended location of action in order to achieve efficient targeted delivery. Liposomes, nanogels, and other nanotechnologies have all been researched as medication carriers for effectively targeting specific tissues.

In order to produce adequate or sustained medication concentrations, controlled or modified-release formulations change the pace and timing at which a drug is released. Dexedrine was the first Controlled-Release (CR) formulation produced in the 1950. During this time, more pharmaceuticals were designed as CR, and transdermal patches were introduced to allow drugs to slowly absorb through the skin. Since then, a slew of other CR products have been developed to account for the physiochemical features of various medications, including depot injections for antipsychotics and once-a-month doses for sex hormones. Since the late 1990, the majority of CR formulation research has focused on using nanoparticles to reduce drug clearance rates.

Due to their huge sizes or electrostatic charges, pharmaceutical formulations containing peptides, proteins, antibodies, genes, or other biologic components frequently experience absorption problems and may be prone to enzymatic destruction once they enter the body. For these reasons, contemporary efforts in medication delivery have focused on using liposomes, nanoparticles, fusion proteins, and other techniques to avoid these difficulties. Intracellular administration of macromolecules *via* chemical carriers is most advanced for RNA, as evidenced by RNA-based COVID-19 vaccines, but proteins and DNA have also been carried into cells *in vivo*.