# Chapter 7
# Lipids, Peptides, and Polymers as Targeted Drug Delivery Vectors in Cancer Therapy

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## ABSTRACT

*The authors aim to describe valuable information and experimental reviews that may help to develop and design different formulation, which can boost up the overall efficiency of the final product. Further, they explained the overall efficiency, method of preparation, target delivery approaches, drawbacks, and other characteristics in relation to lipids, peptides, polymers, and vaccines. In addition, they also propose to uncover the physico-chemical properties, in-process manufacturing issues, and external factors that influence the fate of a medicine. That major includes the excipients, method of preparation, dose, delivery route, chemical and biological properties, drug-drug interaction, drug-body interaction, patient compliance, modifications in lipid based nano-vectors, polymer-mediated delivery systems, conjugate delivery systems, and others. In conclusion, by the end of this chapter, the authors are able to explain a robust mode of delivering active constituents more safely and economically to the target site by showing maximum bioavailability.*

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## INTRODUCTION

As we know cancer is among one of the most leading causes of death worldwide, one in 4 deaths in the US is due to cancer (Yassin et al.,2013). So, our main objective is to elaborate and modulate drug delivery system constituents (lipids, peptides, and polymers) using different carriers and mode of mechanisms as a targeted drug delivery approach against cancer (Fig. 1). Thus, synergizing the therapeutic action by replacing the conventional approaches with a new and advanced set of therapeutics, for example where conventional synthetic lipids like 1,2-Dioleoyl-3-trimethylammonium propane (DOTAP), 1,2-di-O-octadecenyl-3-trimethylammonium propane (DOTMA) are now replaced with functional lipids showing their own anti-cancer properties. There are thousands of drug delivery system that comprises of lipids and excipients to develop the desired formulation. Notable aspects of development in the application of drug delivery systems have occurred in cancer therapy over few decades.(Alavi& Hamidi, 2019).There is a constant increase in the number of cancer cases that not only requires the development of new effective chemotherapeutic drugs but also unique and different ideas to deliver drug formulations adequately by modulating different physio-chemical properties of delivery systems(Jampílek & Kráľová, 2019).In addition to such properties, these cancer nano-medicines with different carrier systems are capable of delivering chemotherapeutic agents while providing lower systemic toxicity(Bor et zl., 2019). We do not consider the fate or metabolism of these structures which later results in severe cell toxicities causing major disorders. Here, we emphasize on exposing the astonishing effects of lipids, polymers, peptides and other excipients as different carrier moieties in achieving target specifications. Alsoin gene mediated delivery nucleic acid requires a sophisticated delivery vehicle because of its rapid degradation in the circulation, thus these carriers in the form of lipids hold up the bottleneck in RNA delivery systems. (Tam et al., 2013)There are many techniques to reduce the overall load on such excipients as like, the dose for an anticancer drug can be reduced as one Active Pharmaceutical Ingredients (API) will be used to carry another pharmaceutically active ingredient giving synergism and reducing the overall ratio of core active pharmaceutical ingredient and avoiding the unnecessary burden of excipients to the molecule, and manufacturing cost. Different techniques have been generated that potentiates the controlled release of drug into the active site. (Hardenia et al., 2019). Thus, exempting body from unnecessary load of un-metabolized constituents and ensures the controlled drug release systematically. However, conventional liposomal formulations offer a minimal degree of protection to the normal cells because they are made up of conventional lipids. A practical step forward to this end would be to substitute such lipids with bioactive or molecularly targeted lipids using conjugated Polyethylene glycol (PEGylated) and poly(lactic-co-glycolic acid) (PLGA nanoparticles) (Li et al., 2015). The development of anti-ligase lipid-based liposomes for administrating DNA alkylating drugs using polymers such as timazolamide and doxorubicin gained immense importance in cancer therapeutics (Prasad et al.,2016). These novel dosage forms will not only deliver the drug but also sensitizes cancer cells by inhibiting the elevated ligases. Together, this reduces the dose of the chemotherapeutic agent and also exemplifies conceptually new combinatorial approach for the effective treatment of cancer. In the beginning stage of liposomes as an anti-cancer therapeutics different lipid were used to develop liposomal formulation, as the encapsulation of drugs in liposomes enhances the therapeutic index. However, the above formulations are made up of conventional lipids with very less on no positive charge. Theses formulations were made from conventional lipids (DOTAP, DOTMA etc.) holds success up to some level, till the gene therapy came into existence. In 2010, Davis et al. reported the delivery of genetic material siRNA with the help of cationic lipids or the lipids that possess permanent positive charge (Ozpolat et al.,2014). As the charge on nucleic acids