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## Unlocking the Potential of RNA Nanoparticles: A Breakthrough Approach to Overcoming Challenges in Colon Cancer Treatment

In Press, (this is not the final "Version of Record"). Available online 13 March, 2024

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Published on: 13 March, 2024

DOI: [10.2174/0113892010285554240303160500](https://doi.org/10.2174/0113892010285554240303160500)

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### Abstract

Globally, one of the leading causes of cancer-related deaths is colon cancer. As this form of cancer has a tremendous potential to metastasize, effective treatment is complicated and sometimes impossible. Despite the improvement of conventional chemotherapy and the advent of targeted therapies, overcoming multi-drug resistance (MDR) and side effects remain significant challenges. As a therapeutic intervention for targeted gene silencing in cancer, RNA technology shows promise and certain RNA-based formulations are currently undergoing clinical studies. Various studies have reported that RNA-based nanoparticles have demonstrated substantial promise for targeted medication delivery, gene therapy, and other biomedical applications. However, using RNA as a therapeutic tool presents severe limitations, mainly related to its low stability and poor cellular uptake. Nanotechnology offers a flexible and tailored alternative due to the difficulties in delivering naked RNA molecules safely in vivo, such as their short half-lives, low chemical stability, and susceptibility to nuclease degradation. In addition to shielding RNA molecules from immune system attacks and enzymatic breakdown, the nanoparticle-based delivery systems allow RNA accumulation at the tumor site. The potential of RNA and RNA-associated nanomedicines for the treatment of colon cancer, as well as the prospects for overcoming any difficulties related to mRNA, are reviewed in this study, along with the current progress of mRNA therapeutics and advancements in designing nanomaterials and delivery strategies.

**Keywords:** [Nano-formulation](#), [mRNA](#), [Polymer](#), [Toxicity](#), [Multi-drug resistance \(MDR\)](#), [Lipid-based nanoparticles](#), [Polymerbased nanoparticles](#).

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