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ISSN: 2167-7956
Journal of Biomolecular Research & Therapeutics

Perspective

Approaching the Polymeric Delivery Methods for Therapeutic Nucleic Acids

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DESCRIPTION

Numerous therapeutic uses for nucleic acid-based gene therapy include the development of novel vaccine formulations and the treatment of genetically based disorders. Carrier systems are necessary because unbound nucleic acids have poor pharmacokinetics and are rapidly destroyed by nucleases found in extracellular matrix and seldom cross cellular membranes. The development of nucleic acid-based therapeutic products requires appropriate carriers that shield the nucleic acid from enzyme attack, extend circulation time after systemic delivery and aid in cellular binding and internalization. However, using them has several significant limitations. As a result the utilization of non-viral carrier systems based on cationic lipids and polymers has received considerable attention. The characteristics of polymer-based nucleic acid formulations are the main emphasis. The various polymeric systems are summarized and the cellular obstacles are covered. The therapeutic status of formulations containing non-viral nucleic acids.

Nucleic acids have emerged as appealing therapeutic intervention techniques as understanding of genetic disease. By limiting gene expression nucleic acids can either increase the creation of insufficiently functional proteins or decrease it. The therapeutic potential of nucleic acids is however constrained by their rapid degradation by nucleases excretion or uptake by tissues other than their intended targets, immune activation by binding to Toll-like receptors and ineffective cellular uptake because of their size and hydrophobicity. Therefore in order to use nucleic acids as medications carrier systems that offers protection, direct tissue distribution of nucleic acids. Numerous carrier systems include as synthetic and natural lipids and polymers, viral vectors and natural and synthetic lipids have all been studied. Inorganic particles are also investigated as carrier systems. By introducing one or more therapeutic nucleic acids into the patient's cells and replacing or correcting a malfunctioning gene is a therapeutic approach for the treatment of genetic illnesses. Effective clinical gene therapy procedures involve either gene alteration of autologous cells (such as hematopoietic stem cells) that are then transplanted back into the patient or gene delivery to target cells or tissues. While most therapeutic nucleic acids disrupt the DNA-mRNA-protein axis, additional points of intervention have become available as our understanding of the numerous RNA species that control not just gene expression but also other cellular functions has grown.

At the mRNA level gene expression can also be suppressed. In order to suppress the translation of the target protein nucleic acid attach to complementary target mRNA and cause its dependent destruction or translational repression. Small interfering RNAs are a second category of therapeutic nucleic acids that control gene expression. Double-stranded small interfering RNA (siRNA) and microRNA are examples of these tiny non-coding RNAs (miRNA). One of the two RNA strands with a length of 20 to 30 bases is broken down when siRNA is introduced into the cytosol. The multiprotein RNA-induced silencing complex specifically retains the guide strand the last strand of the siRNA duplex. Post-transcriptional regulation of gene expression by miRNAs which are short non-coding endogenous RNA molecules that control cellular and mostly function, translational repression but occasionally also by mRNA cleavage is a comparable process. Some miRNAs have been demonstrated to control cancer treatment-relevant cell growth and apoptotic processes. Some miRNAs may also act as tumor-suppressor miRNAs or oncogenes. Tumor-suppressor miRNAs block these pathways whereas negatively regulate tumour suppressor genes and that influence cell differentiation or death. Tumor-suppressor miRNAs are expressed in low levels in cancer, which promotes the growth of neoplasms. Therefore, miRNA treatment may be a potent therapeutic strategy. All nucleic acids are larger than typical tiny medicines. Additionally, they have a limited biological stability since nucleases found in physiological fluids can break them down quickly. They are restricted from passing through lipid cell membranes and entering target cells, which is an important aspect of their hydrophilic nature and overall strong negative charge. Finally, this presumably causes localization of nucleic acids in the early endosomes and lysosomes, where they are broken down by endolysosomal enzymes, even in cases of restricted intracellular absorption. All of these elements impede the advancement of nucleic acid therapy and contribute to its low therapeutic efficacy.

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Received: 03-Oct-2022, Manuscript No. BOM-22-18621; **Editor assigned:** 06-Oct-2022, Pre QC No. BOM-22-18621(PQ); **Reviewed:** 20-Oct-2022, QC No. BOM-22-18621; **Revised:** 27-Oct-2022, Manuscript No. BOM-22-18621(R); **Published:** 04-Nov-2022, DOI: 10.35248/2167-7956.22.11.240.

Citation: Raymond E (2022) Approaching the Polymeric Delivery Methods for Therapeutic Nucleic Acids. J Biol Res Ther. 11:240.