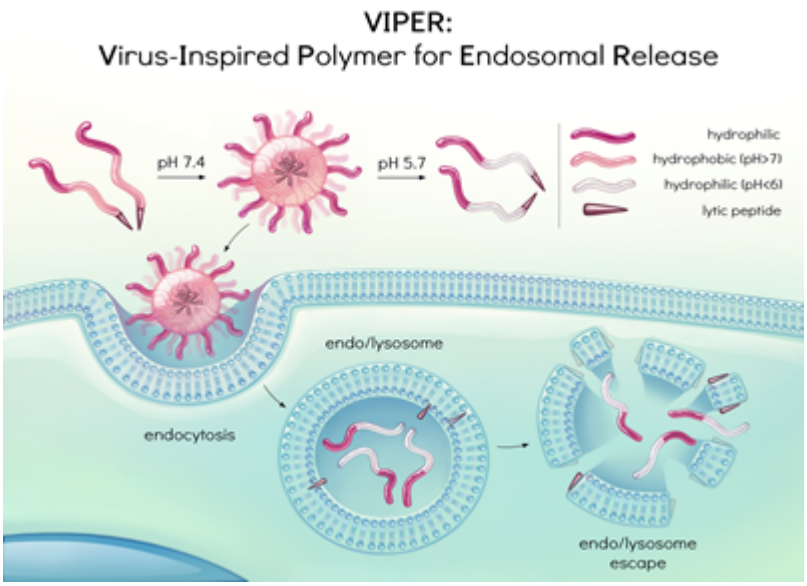
Endosome Escape-Enabling Polymer Micelles for Targeted Delivery of Nucleic Acids and Peptides

Innovative pH-sensitive polymer micelles and membrane-lytic peptides enhance the intracellular delivery and efficacy of therapeutic agents through enabling endosome escape.



What is the Problem?

Delivering therapeutic agents, such as nucleic acid-based drugs, effectively into cells remains a significant challenge in medical treatments. Traditional drug delivery methods often face issues such as poor cellular uptake, degradation of the therapeutic agents before reaching their target, and non-specific distribution leading to side effects. For delivering nucleic acids, two primary types of delivery vehicles are used: viral and non-viral systems. Viral vectors are effective, but they pose immunogenicity and safety risks and can be costly to produce. Non-viral vectors, such as synthetic polymers, are safer and more cost-effective, but they are significantly less efficient at gene transfer compared to viral vectors. As a result, there is a need for a more efficient and targeted delivery system that can overcome these barriers and improve the efficacy of treatments.

Technology ID

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Category

Materials/Nanomaterials
Materials/Polymers
Therapeutics/Platform Technology
Selection of Available Technologies

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What is the Solution?

The novel technology offers a virus-inspired polymer for endosomal release (VIPER), a pH-sensitive, peptide-functionalized polymer for targeted nucleic acid delivery that mimics the mechanism of viruses. The polymer contains a pH-sensitive micellar domain to which a membrane-active peptide is attached. These polymer micelles are designed to respond to the acidic environment within endosomes, revealing membrane-lytic peptides that penetrate and destabilize the endosomal membranes, thereby releasing the therapeutic cargo. By conjugating highly lytic peptides to the pH-sensitive polymer, the system ensures effective transfection both in vitro and in vivo. This approach not only improves the stability and delivery of therapeutic agents but also minimizes side effects by targeting the release specifically within the cellular environment.

What is the Competitive Advantage?

Polymeric Carrier: The polymeric carrier is scalable and more cost effective than viral vectors. It has also been demonstrated that the polymeric carrier can be given repeatedly due to lack of antibody generation.

Enhanced Delivery: The use of potent membrane-lytic peptides like melittin significantly improves the intracellular delivery of therapeutic agents by facilitating endosomal escape, increasing their efficacy.

in vivo Proof of Concept: Demonstrated effective peptide and nucleic acid delivery in both cultured mammalian cells and in vivo models, highlighting its potential for real-world applications.

Versatility: This delivery system can be adapted for a wide range of therapeutic agents, making it a versatile platform for different medical applications.

Patent Information:

US20190175752A1

References

1. Peeler, D. J., Thai, S. N., Cheng, Y., Horner, P. J., Sellers, D. L., Pun, S. H.(2018) , https://pmc.ncbi.nlm.nih.gov/articles/PMC6331286/, https://www.sciencedirect.com/journal/biomaterials, 192, 235-244