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Optimized Stuffer Sequence for Enhanced AAV Gene Therapy Productivity and Safety

Stanford researchers have created an optimized stuffer sequence derived from the human BMP-10 3'UTR to enhance the packaging efficiency, productivity, and safety of recombinant adeno-associated virus (rAAV) vectors in gene therapy applications. This technology ensures optimal payload size, reducing risks of truncated products and improving therapeutic efficacy.

The field of gene therapy using rAAV vectors is growing rapidly due to their potential to effectively deliver therapeutic genes. However, a significant challenge in this field is ensuring that the payload size within rAAV remains within the optimal range (4-4.6 kb) to ensure efficient packaging, high productivity, and genomic integrity. A payload size of less than 4 kb compromises productivity and a payload size of less than 2.4 kb compromises genome integrity that produces truncated products leading to heterogeneous drug formulations, and reduced production yields, thereby posing safety and efficacy concerns.

This technology addresses these issues by introducing a specially designed stuffer sequence to maintain the ideal AAV payload size, enhancing overall vector performance and therapeutic outcomes. This technology introduces an optimized stuffer sequence derived from the 3'UTR of the human BMP-10 transcript to enhance the performance of rAAV vectors in gene therapy. By maintaining the ideal payload size (4-4.6 kb), this stuffer sequence ensures high packaging efficiency, genomic integrity, and consistent production yields. Extensive evaluation through machine learning and wet lab validation has demonstrated its effectiveness, making it a superior solution for safer and more efficient gene therapy vector manufacturing.

Stage of Development:
Prototype

Applications

- **Gene Therapy:** Applicable for developing optimal AAV-based gene therapies targeting genetic disorders
- **Research Tool:** Enhances the production of reliable AAV vectors for laboratory research
- **Pharmaceutical Development:** Key component for manufacturing safer and more effective viral vector-based pharmaceuticals

Advantages

- **Optimized Payload:** Ensures ideal AAV payload size (4-4.6 kb), boosting vector productivity and genomic integrity
- **Safety:** Human-origin stuffer sequence with no adverse genetic elements, minimizing safety concerns
- **Enhanced Manufacturing:** Reduced risk of truncated products and non-specific payloads, leading to higher production yields
- **Efficacy:** Minimizes heterogeneity in drug products, enhancing therapeutic efficacy
- **Versatility:** Applicable across various AAV serotypes and gene therapy applications, broadening its utility in research and development

Patents

- Published Application: WO2026055148

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