Programmable Peptide Nucleic Acid-Based Nanoplatform for Customizable Drug Delivery

Tech ID: 34434 / UC Case 2025-555-0

ABSTRACT

Researchers at the University of California, Davis have developed a peptide nucleic acid-based system enabling precise and customizable delivery of antigens, adjuvants, and targeting molecules for improved cancer immunotherapy.

FULL DESCRIPTION

This technology provides a programmable nanoplatform using single-stranded peptide nucleic acid scaffolds combined with oligonucleotide helper strands to self-assemble antigenic molecules, targeting moieties, and immunomodulatory adjuvants into an oligomer under physiological conditions. It protects therapeutic components from enzymatic degradation and allows highly specific targeting of antigen-presenting cells to trigger effective and durable immune responses against cancer. The platform supports diverse molecular payloads, including tumor-associated antigens, peptides, small molecules, and imaging agents, offering flexible, robust cancer vaccine design and treatment opportunities.

APPLICATIONS

- Therapeutic cancer vaccines for immuno-oncology.
- Customizable drug delivery systems for peptide and small molecule therapeutics.
- Targeted delivery platforms for antigen-presenting cells.
- Imaging agent delivery combined with therapeutics for diagnostics.
- Development of novel vaccine adjuvants and immunomodulatory treatments.
- Personalized medicine approaches using neoantigen-based immunotherapies.

FEATURES/BENEFITS

- Achieves high binding specificity using programmable peptide nucleic acid scaffolds.
- Increases resistance to nuclease and protease degradation.
- Enables co-delivery of multiple therapeutic components such as antigens, adjuvants, and targeting molecules.
- Improves targeting of professional antigen-presenting cells to enhance immune responses.
- Offers flexible design compatible with peptides, small molecules, and chemical synthesis.
- Self-assembles under physiological conditions for practical in vivo application.
- Supports delivery of diverse immunomodulators, including CpG oligonucleotides and chemotherapy drugs.
- Enhances targeting efficiency of cancer vaccines to immune-relevant cells.
- Ensures reliable co-delivery and protection of antigens and adjuvants from degradation.
- Overcomes limited flexibility and specificity of traditional nucleic acid-based scaffolds.
- Bypasses physiological barriers that reduce vaccine efficacy.
- Increases immune activation by providing precise delivery systems.

PATENT STATUS

Patent Pending

RELATED MATERIALS

- Designing Programmable Peptide Nucleic Acid-based Nanovaccines for Anticancer Immune Activation - 11/07/2025

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OTHER INFORMATION

KEYWORDS

antigen-presenting cells, drug delivery, immune activation, immunomodulator, nanoplatform, peptide nucleic acid, programmable scaffold, therapeutic cancer vaccines, tumor targeting, vaccine delivery

CATEGORIZED AS

- **Biotechnology**
  - Health
- **Medical**
  - Delivery Systems
  - Disease: Cancer
  - Therapeutics
  - Vaccines
- **Nanotechnology**
  - NanoBio

RELATED CASES

2025-555-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Novel Solid Tumor Chemodrug LLS2
- Affinity Peptides for Diagnosis and Treatment of Severe Acute Respiratory Syndrome Coronavirus 2 and Zika Virus Infections

- Nanoparticles for Drug Delivery, Tissue Targeting and Imaging Analysis
- Conjugates That Combine HDAC Inhibitors and Retinoids into Disease Preventatives/Treatments
- A Novel RGD-Containing Cyclic Peptide for use in Cancer Imaging and as a Targeted-Therapy Ligand
- Site-Specific Ligation and Compound Conjugation to Existing Antibodies
- Functional Illumination in Living Cells
- Multifunctional Porphyrin-Based Nanomedicine Platform
- A Two-step Drug Delivery System Based on Click Chemistry
- Transformable Smart Peptides as Cancer Therapeutics
- Engineered Biomaterial to Prevent Endothelial Inflammation
- Systems and Methods of Single-Cell Segmentation and Spatial Multiomics Analyses
- Proteoglycan Mimetics For Enhanced Wound Healing Angiogenesis And Vascular Repair
- Nanoplatform for Cancer Therapy
- Ligands for Improved Angiogenesis and Endothelialization of Blood Contacting Devices

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