Neuronal Injury Targeted Engineered Placental Mesenchymal Stem Cell Derived Extracellular Vesicles

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ABSTRACT

Researchers at the University of California, Davis have developed an extracellular vesicle composition conjugated with targeting peptides to localize treatment to central nervous system injury sites, enhancing neural tissue preservation and recovery.

FULL DESCRIPTION

This technology involves extracellular vesicles, specifically exosomes derived from placental mesenchymal stromal cells, conjugated with targeting moieties such as the CAQK nanopeptide that specifically binds to Tenascin-C expressed at CNS injury sites. The extracellular vesicle conjugates are designed to localize to injured spinal cord or brain tissue to deliver neuroprotective and neuroregenerative effects. Various conjugation methods like click chemistry and lipid insertion enable effective surface modification of these vesicles. The compositions can be administered through intravenous, intrathecal, intraamniotic, or intranasal routes in acute or chronic CNS injury contexts, resulting in improved motor function, reduced inflammation, and decreased neuronal apoptosis.

APPLICATIONS

- Therapeutic treatment of acute, subacute, and chronic spinal cord injuries.
- Management and recovery enhancement of traumatic brain injuries.
- Pharmaceutical formulations of extracellular vesicle-based neurotherapeutics.
- Non-invasive and invasive CNS drug delivery systems including intravenous and intranasal administration.
- Potential adjunct therapy in neurorehabilitation centers and trauma care units.
- Development of next-generation regenerative medicine products targeting neurological disorders.

FEATURES/BENEFITS

- Targets therapeutic extracellular vesicles (EVs) to CNS injury sites by using injury-homing nanopeptides (e.g., CAQK).
- Provides a potent neuroprotective EV source by deriving EVs from placental mesenchymal stromal cells.
- Enables flexible surface functionalization by supporting multiple conjugation chemistries (e.g., click chemistry, lipid insertion, amine coupling).
- Expands delivery options by supporting both intravenous and intranasal administration routes.
- Improves preclinical outcomes by increasing motor function while reducing inflammation and neuronal death.
- Reduces safety and logistical risks by delivering an acellular therapy rather than cell-based treatments.
- Addresses the lack of effective therapies for spinal cord injury and traumatic brain injury by introducing a neuroprotective EV-based approach.
- Overcomes poor localization of therapeutics by increasing targeting and accumulation at CNS injury sites.
- Mitigates secondary injury cascades by reducing persistent inflammation and neuronal apoptosis.
- Bypasses systemic delivery barriers to damaged CNS tissue by enabling effective IV and intranasal delivery.

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Exosome-Mimicking Nanovesicles
- Systems and Methods of Single-Cell Segmentation and Spatial Multiomics Analyses
- Hydrogelated Cells for Regenerative Medicine Applications
- Proteoglycan Mimetics For Enhanced Wound Healing Angiogenesis And Vascular Repair
- Ligands for Improved Angiogenesis and Endothelialization of Blood Contacting Devices

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OTHER INFORMATION

KEYWORDS

apoptosis, CAQK peptide, central nervous system, exosome, mesenchymal stromal cell, neuroregeneration, spinal cord injury, targeted delivery, Tenascin-C, traumatic brain injury

CATEGORIZED AS

- **Medical**
  - Disease: Central Nervous System
  - Therapeutics

RELATED CASES

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