First-in-Class Vaccine Platform to Halt Prion Transmission Across Species

A first-in-class vaccine approach to prevent or delay fatal, transmissible prion diseases in humans and animals.

Technology

Researchers at NYU have developed a novel multispecies peptide-based vaccine platform designed to prevent or treat prion diseases. This approach leverages conserved sequences across multiple species to create synthetic peptides that do not match any known endogenous prion protein. These peptides are formulated into polymers or expressed in live attenuated bacterial vectors, enabling mucosal or parenteral delivery. The platform induces robust systemic and mucosal immunity capable of neutralizing infectious prions and preventing disease onset. Preclinical studies demonstrate protection against prion disease in murine models, with translational potential in livestock and wildlife applications (e.g., chronic wasting disease in deer).

Background

Prion diseases, such as Creutzfeldt-Jakob disease (CJD), chronic wasting disease (CWD), and bovine spongiform encephalopathy (BSE), are caused by the misfolding of the native prion protein (PrP) into a pathogenic form (PrP^Sc), which propagates in the brain, causing irreversible damage. These diseases are uniformly fatal, with no approved treatments or vaccines. Current efforts in disease management focus solely on containment and culling. A safe and effective vaccine could radically shift the paradigm for prion disease control.

Development Status

Key peptide sequences have been identified and synthesized based on conserved regions of prion proteins across species. These peptides have been expressed in attenuated bacterial vectors and formulated into vaccine candidates. Preclinical studies in mice demonstrate that vaccination induces robust systemic and mucosal immune responses and significantly delays or prevents disease onset following prion exposure. Ongoing work focuses on optimizing formulation and scaling for broader translational studies.

Applications

- **Human health:** Prophylactic or therapeutic vaccination for at-risk populations (e.g., familial prion disease, iatrogenic exposures).
- **Animal health:** Vaccination of livestock and wildlife to control zoonotic transmission (e.g., BSE, CWD).
- **Biodefense:** Potential application in preventing bioterrorism-related prion dissemination.
- **Research tools:** Novel epitopes for diagnostics and immunologic studies of prion diseases.

Advantages

Technology ID

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Category

Life Sciences/Therapeutics/Neurodeg Diseases

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- **Cross-species protection:** Synthetic peptides derived from conserved PrP regions across species.
- **Immunogenic design:** Peptides differ from natural PrP, minimizing the risk of immune tolerance.
- **Modular formulation:** Vaccine can be delivered as recombinant protein polymers or live attenuated bacterial vectors.
- **Robust immune activation:** Elicits mucosal and systemic immunity, key for protection against oral and peripheral exposure.
- **Safety:** Designed to avoid autoimmunity by excluding sequences identical to native PrP proteins.

Intellectual Property

NYU has filed a pending U.S. non-provisional patent application covering the compositions and methods for the treatment and prevention of prion disease.