Novel Virus-Like Particle (VLP)-Based Vaccines Against Alzheimer's Disease Tau Pathology

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Technology description

A unique virus-like particle (VPL)-based platform technology to develop vaccines against tauopathies. This immunotherapy approach has significant potential as a therapy for neurodegenerative tauopathies such as, for example, Alzheimer’ s disease and MAPT pathology induced by traumatic brain injury.

Background

Alzheimer’ s disease (AD) is a neurodegenerative disease characterized by progressive decline in cognition. The major pathological hallmark responsible for this decline is the accumulation of hyperphosphorylated Microtubule Associated Protein Tau (MAPT or Tau) into aggregated neurofibrillary tangles (NFTs). This pathological misfolding of MAPT is also responsible for several other neurodegenerative tauopathies besides AD and following traumatic brain injuries (TBIs). Although pathological-MAPT (p-MAPT) has been therapeutically targeted to halt MAPT-mediated neurodegenerative cascades, many such approaches are not feasible in humans or did not meet successful end-point when tested in devastating movement disorders with pure tauopathy. Furthermore, despite mounting evidence that pathological misfolding in MAPT ensue in response to TBI/chronic traumatic encephalopathy (CTE), no attempts have been made to target p-MAPT to improve the clinical outcome following TBI. Based on this, there is an urgent need to develop highly efficacious MAPT-targeted therapies to block neurodegenerative changes in AD and related tauopathies as well as following TBI/CTE.

One promising therapeutic strategy currently being tested in AD is immunotherapy. There are several challenges with this approach. First, it is often difficult to elicit strong antibody responses against self-antigens like MAPT. Second, immune responses against self-antigens have the potential to cause substantial side effects. Furthermore, while the administration of purified MAPT antibodies (passive immunization) shows promising trends in reducing pathological MAPT in recent studies, they are not cost-effective due to the prohibitively expensive process of making purified antibodies. Finally, in the context of MAPT pathology, neuroinflammation, which can ensue in response to brain trauma, accelerates MAPT pathology and cognitive impairment in an hTau mouse model of tauopathy (Bhaskar et al., 2010, Neuron 68:19-31). It is therefore important to develop a MAPT-targeted immunotherapy

that can successfully elicit a targeted immune response against NFTs while limiting the inflammatory consequences.

Technology Description

Researchers at the University of New Mexico have exploited a unique virus-like particle (VPL)-based platform technology to develop vaccines against tauopathies. This immunotherapy approach has significant potential as a therapy for neurodegenerative tauopathies such as, for example, Alzheimer’s disease and MAPT pathology induced by traumatic brain injury.

Publication

Qß Virus-like particle-based vaccine induces robust immunity and protects against tauopathy

Article & Press Release

Memory Preserver - UNM Researchers Develop Vaccine That Could Protect Against Alzheimer's
Researchers test vaccine they hope could stem Alzheimer's
KNME's In Focus Interview - Vaccine for Alzheimer's is in the Works

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Application area

Highly efficient, safe, economical, and state-of-the-art immunotherapy approach based on a Virus-Like Particle (VLP) platform

Targets four disease-related modifications in microtubule associated tau protein (MAPT)
This VLP-based immunotherapy, targeting p-MAPT, provides a potential opportunity for developing future therapies against p-MAPT/NFT-induced neurodegenerative alterations
Elicits antibodies against pathological tau without inducing a severe inflammatory response
Vaccination leads to significant improvements in recognition and spatial memory
Vaccination decreases neurofibrillary tangles in the hippocampus and cortex in a mouse model of tauopathy
Prevents neuronal cell loss induced by tau pathology
Applicable to neurodegenerative tauopathies (such as Alzheimer’ s Disease) and tauopathy-resultant from TBI and CTE

Institution

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