

## Exploring Cutting-Edge Advancements in Dementia Treatment

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Alzheimer's disease (AD) remains the leading cause of dementia worldwide and poses a major challenge to aging societies. Recent advances in biomarker discovery, disease-modifying therapies, and neuromodulation technologies have significantly reshaped the landscape of dementia diagnosis and treatment. This lecture will review cutting-edge developments in AD therapeutics and translational research, with particular emphasis on precision medicine and early intervention strategies. The presentation will first summarize the evolution of the amyloid hypothesis and the emergence of blood-based biomarkers, especially plasma phosphorylated tau (p-tau217), which now approaches imaging-level diagnostic accuracy for amyloid pathology. The integration of plasma biomarkers, amyloid PET, tau PET, and MRI into modern diagnostic workflows has enabled earlier identification of individuals at risk for AD, including preclinical and prodromal stages.

Recent breakthroughs in anti-amyloid monoclonal antibody therapies, including lecanemab and donanemab, will be discussed, focusing on their clinical efficacy, long-term outcomes, and limitations such as amyloid-related imaging abnormalities (ARIA). Emerging prevention trials targeting preclinical AD populations will also be highlighted.

In addition, the lecture will explore novel non-pharmacological interventions, including repetitive transcranial magnetic stimulation, transcranial direct current stimulation, sensory stimulation, photobiomodulation, and focused ultrasound. Special attention will be given to the glymphatic system as a potential therapeutic target linking vascular dysfunction, proteinopathy, and neurodegeneration.

Experimental and clinical evidence suggests that glymphatic dysfunction may contribute to mixed dementia and post-stroke cognitive impairment.

Together, these advances support a future model of personalized dementia care integrating biomarkers, disease-modifying therapies, vascular management, and smart neurotechnology to delay cognitive decline and improve quality of life.