Trigger, Probe, and Measure Condensation, Folding, and Aggregation of Biomolecules Associated With Alzheimer's and Amyloid Diseases

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OTHER INFORMATION
KEYWORDS
a-Helix, Circular dichroism,
Coil-to-helix transition,
Differential pulse voltammetry,
Electroreduction, In situ UV absorbance, Polylysine,
Protonation-sensitive biomolecular systems, Site-selective electrochemistry

CATEGORIZED AS
▶ Biotechnology
▶ Health
▶ Communications
▶ Optical
▶ Medical
▶ Diagnostics
▶ Research Tools

RELATED CASES
2022-786-0
BACKGROUND

Diagnosis, drug development, and treatment of degenerative diseases such as Alzheimer’s and Parkinson’s disease hinge on studying their characteristic protein aggregation. Techniques that lack control over the aggregation process or take too long to enable efficient analysis are creating a bottleneck in critical research. Most methods of studying protein aggregation separate the steps of activating condensation and measuring the development of protein assemblies (i.e., the analyte). Combining these steps would allow much faster and more comprehensive research to be conducted regarding these high-priority diseases.

DESCRIPTION

Researchers at the University of California, Santa Barbara, have combined electrochemistry with optical spectroscopy to create a technology that simultaneously triggers, controls, and analyzes the condensation and/or aggregation of biomolecules and proteins. A key aspect of the methodology is the direct, low-voltage electro-reduction (or oxidation) of specific chemical moieties within the analyte of interest, acting as a proxy for charge-mediated condensation and/or protein assembly. The condensation of analytes is triggered using a conducting electrode surface biased at specific electrochemical potentials. Multi-modal optical spectroscopy then provides in situ data about the structural evolution of analytes and their assemblies. This technology is simple to implement, quick to generate results, and provides a direct readout of protein condensation, conformational folding, assembly, and/or aggregation — critical information for the study of amyloid or other plaque-like aggregates, complexes, or fibrils associated with diseases. Moreover, the technology could be used to evaluate drugs, antibodies, and other effectors that may inhibit, regulate, or govern chemical and/or biological processes and pathways leading to the formation of protein fibrils, filaments, and amyloids associated with diseases.

ADVANTAGES

- Simultaneously triggers, controls, and analyzes the condensation and/or assembly of biomolecules and proteins.
- In situ measurement of analytes at all stages of protein condensation, structural evolution, and assembly/aggregation, including early intermediates via rapid assay (order of minutes).

APPLICATIONS

- Disease Research
  - Degenerative and prion-related diseases, including Alzheimer’s Disease, Parkinson’s Disease, Pick’s Disease, and Type II Diabetes
- Drug Development

PATENT STATUS

Patent Pending
RELATED MATERIALS

▶ Reversible electrochemical triggering and optical interrogation of polylysine α-helix formation - 11/26/2021

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

▶ Polymer Shutter For Infrared Detection Systems