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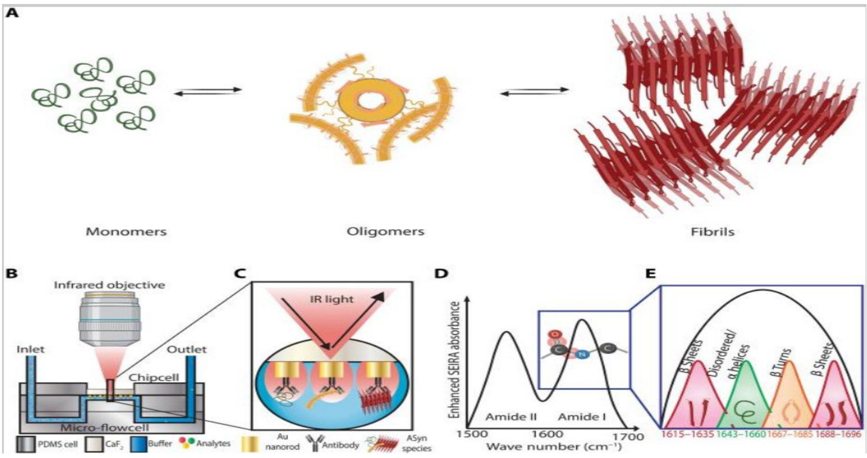
Licensing Opportunity

TTO – Technology Transfer Office

ImmunoSEIRA: Neurodegenerative Disorder Biosensing System



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6.2510

Keywords

Nanophotonics, nanoplasmonics, infrared spectroscopy, microfluidics, immunoassay, artificial intelligence, multiplexing

Intellectual Property

US PATENT APPLICATION n° 18/756,559

Publication

Deepthy Kavungal et al., Artificial intelligence-coupled plasmonic infrared sensor for detection of structural protein biomarkers in neurodegenerative diseases. Sci.Adv.9,eadg9644(2023).DOI:10.1126/sciadv.adg9644

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Description

Neurodegenerative disorders (NDDs) such as Parkinson’s, Alzheimer’s, and ALS involve misfolded protein aggregates that evolve from monomers to oligomers and fibrils. However, existing diagnostic tools cannot distinguish these structural forms, lack sensitivity in complex samples, and often require high-purity protein preparations.

This invention introduces a next-generation biosensing platform capable of resolving, quantifying, and tracking structural biomarkers directly in biological fluids, based on plasmonic nanostructures coupled to infrared absorption (SEIRA) and target-specific capturing agents. It provides:

- Label-free, surface-enhanced IR structural fingerprinting of NDD-related protein species.
- Quantitative discrimination of monomers, oligomers, and fibrils.
- Real-time, time-resolved spectral acquisition for kinetic and conformational tracking.
- High specificity via immobilized antibodies or other capture agents.
- Operation in complex biomatrices, including human CSF.
- This enables direct structural analysis of disease-relevant aggregates, overcoming the fundamental blind spots of conventional assays.

Advantages

- Structural resolution (β-sheet / α-helix / disordered signatures) impossible with existing assays
- Quantitative mixtures analysis via AI, including oligomer–fibril ratios
- Time-resolved monitoring of binding and conformational evolution
- Multiplexing across several biomarkers
- High throughput (up to 96 wells) for research or screening
- No labels, low sample requirements, and compatible with complex fluids

Applications

- Early-stage NDD diagnosis
- Patient stratification and progression monitoring
- Evaluation of therapeutic effects on aggregation pathways
- Drug screening for aggregation inhibitors
- Research into protein misfolding mechanisms