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Graphene biosensors for label-free detection of blood-based biomarkers for Alzheimer's disease

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Statement of the Problem: Alzheimer's disease is the most common form of dementia leading to a massive irreversible neuronal loss and cognitive decline. It affects over 7 million people in Europe and 5.5 million in America and this figure is expected to double every 20 years as the population ages. Early detection of the AD is the key requirement for developing disease-modifying treatments as studies show that pathology exceeds symptom by years. The existing techniques for detection using CSF and Imaging biomarkers are highly expensive and invasive. Blood-based biomarkers, however, can provide a simple and effective way for the screening of AD patients. The talk covers the latest progress in the EU H2020 BBDiag research project, for the development of blood biomarker-based diagnostics for early-stage AD employing by multiplexed graphene biosensor arrays.

Methodology & Theoretical Orientation: Two novel graphene biosensors were developed for label-free detection of DNA and protein biomarkers, a graphene immunoFET for detection of protein markers and a rGO-graphene electrode for detection of DNA markers.

Findings: The rGO electrode shows enhanced redox current up to 40% higher in comparison with electrodes of bare graphene due to the combination of a high number of electroactive sites on rGO and high conductivity of pristine graphene. A linear range from 10-7M to 10-12M is demonstrated for the biosensor with a detection limit of 1.58 x 10-13M. The immunoFET showed a unique resistance change pattern with high reproducibility and an ultralow detection limit of 1pg mL-1 and high sensitivity of 0.30 Ω/ng/mL.

Conclusion & Significance: We have demonstrated that graphene biosensors can be employed for ultra-sensitive and label-free detection of DNA and proteomic disease biomarkers. The work may lead to the development of cost-effective and minimally invasive point of care diagnostic devices for routine screening of Alzheimer's disease with a panel of biomarkers.

Biography

Ms. Jagriti Sethi is from New Delhi, India and is an Early stage researcher in Plymouth University under the BBDiag Network. She received her bachelor's and Master's in Nanotechnology (2016) from Amity Institute of Nanotechnology, Amity University, India. She has worked with institutions like Central Scientific Instruments Organization and University of Paris and has carried out research on Biocompatible Nanocomposites and 2D Nano sheets as a part of her undergraduate and postgraduate research. She is currently working on the Fabrication of biosensors for blood-based AD biomarker.

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