2024 Seminar  
이길여암당뇨세미나

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| Development of new biophysical diagnosis and 3D sub-brain modeling study for Alzheimer’s Disease |

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Alzheimer's pathology is correlated with structural conformation change of aggregated amyloid beta (Aβ) proteins. We identified the progressive aggregation stages of the Aβ protein growth in a buffer solution using by the near-field THz spectroscopy and the newly defined biophysical marker (DQ) based on real-time THz optical conductance. Frequency-dependent conductance for Aβ aggregates was obtained by measuring the differential transmittance of the time-domain spectroscopy in the THz range with a molar concentration of monomer, oligomer, and fibrillar forms. We also found the new phase transitions within three aggregation steps by label-free continuous Aβ dynamics monitoring during macro scale fibrils from monomers under physiological conditions.[1] Furthermore, we elucidated this basic mechanism by studying how the charge transfer behavior of the surface of three-state-proteins is different on the graphene surface. [2]

Along with biophysical study, I will introduce our recent research of 3D cellular modeling for hippocampus area which is mainly affected in Alzheimer's disease. Our uniformed 3D spheroid culture flatform was developed in microfluidics system with primary neural stem cells mixed adult hippocampal neuron condition. The 3D hippocampal spheroids were generated by loading subgranular zone-derived stem cells and hippocampal neurons subsequently and cultured for 3 weeks with over 90% of cell viability. The spheroids exhibited high uniformity and the circularity of spheroids increased gradually overtime. Moreover, the neural stem cell differentiation and migration dynamics can be addressed in our 3D hippocampal spheroids expressed differently from 2D culture. This advanced *in vitro* hippocampal modeling using our fluidics 3D culture is necessary for translational medical research.

[1] THz Conductance Measurement for Fibrilization of Amyloid Beta Protein. ACS NANO (2020).

[2] Probing Interfacial Charge Transfer between Amyloid-β and Graphene during Amyloid Fibrillization Using Raman Spectroscopy. ACS NANO (2023).