

國立高雄大學應用數學系

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Early-onset Alzheimer's Disease : Mathematical Modeling and Numerical Simulations

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摘 要：

The neuropathological diagnosis of Alzheimer's disease (AD) is associated with the presence of extracellular senile plaques composed of amyloid-beta protein ($A\beta$) and intracellular neurofibrillary tangles composed of highly phosphorylated forms of the microtubule-associated protein tau. In this thesis, we propose a mathematical model for the progression of early-onset AD in entorhinal cortex (EC). This model is based on $A\beta$ cascade hypothesis and involves the interactions among $A\beta$, oligomers of $A\beta$, neurons, astrocytes, microglia and cytokines released from microglia. The feature of our model lies in the indicator of neuroinflammation that is capable of presenting neuroprotective as well as neurotoxic nature of glial cells under healthy and AD state. The rate of change of cell populations are able to be simulated numerically by our model consisting of a system of ODE equations. Our numerical results reveal that the microglial activation may contribute the most to the onset of AD. It provides the future treatments or possible effective combination therapies for the disease.